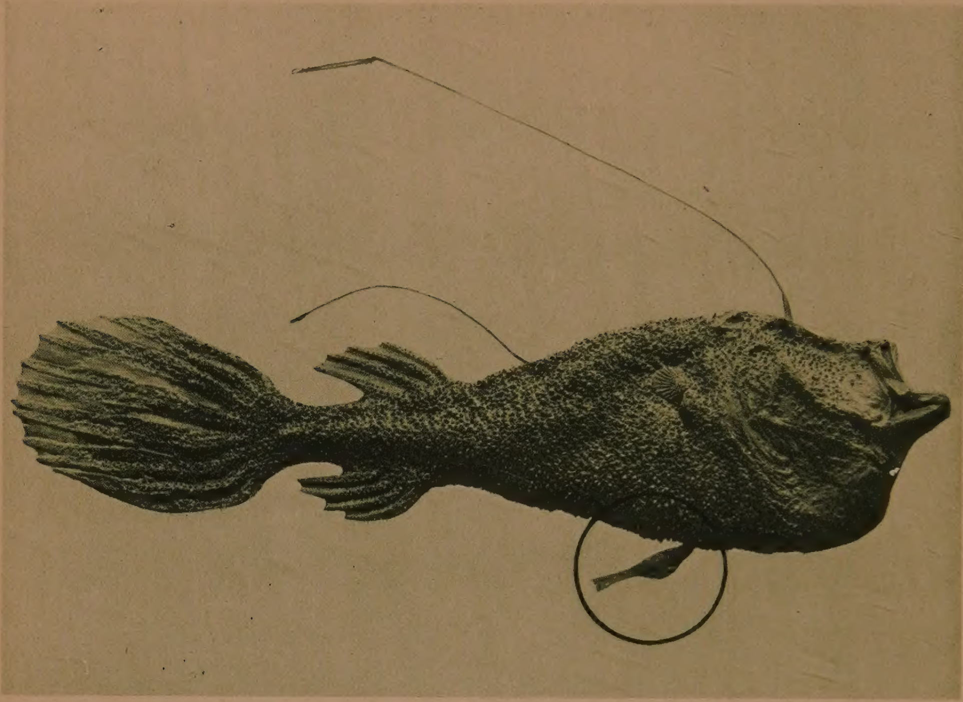
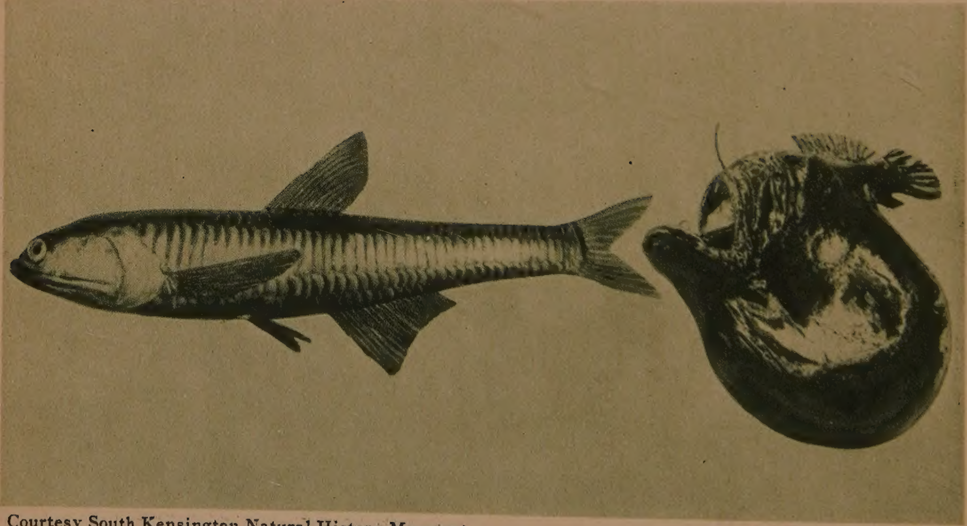
THE BOOK
of
KNOWLEDGE

NATURE'S RESPONSE TO ENVIRONMENT





Courtesy South Kensington Natural History Museum.

THE deep-sea angler fish has recently been receiving special attention at the hands of science. It has certainly developed one of the most amazing adaptions to environment in the form of a luminous blob at the end of a ray of the dorsal fin. Floating about in the darkness of the middle depths of the ocean, between 300 and 600 fathoms below the surface, it is blackish in color, a solitary and sluggish creature feeding on fish. It possesses enormous jaws, may grow to over a yard in length and lies in wait for its prey to come to it. The male is in the last stage of degeneracy, and is only a few inches long. At a very early stage it becomes parasitic on the female. Outgrowths are formed from its snout and chin and unite in front of the mouth. On the female are certain protuberances or papillae. The male fastens on to one of these with his outgrowth. His skin fuses completely with that of the female and she meanwhile passes out from her body fibres and vessels, supplying the decadent male with a circulatory system. The *Ceratias Holboelli* shown above was 40 inches long and the male (in circle), attached to her for life, was but 4 inches, she being about 1000 times the weight of her husband. The angler fish can distend its stomach enormously, as shown in the lower picture of a *Melanocetus* which has swallowed a fish three times its own length and several times its weight. The victim (at left) was seized by the tail and gradually absorbed until it formed a complete circle inside its captor.

The
BOOK *of* KNOWLEDGE

The Children's Encyclopedia

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DEPARTMENTS

- The Earth
- Stories and Legends
- All Countries
- Golden Deeds
- Helps to Learning
- Literature
- Animal Life
- Famous Books
- Dominion of Canada
- The United States
- Familiar Things
- Our Own Life
- The Fine Arts
- Men and Women
- Poetry and Rhymes
- Plant Life
- Things to Make and Things to Do
- Book of Wonder

VOLUME XVI

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This is a short guide to the principal contents of this volume. It is not possible to give all of the questions in The Book of Wonder, or the titles of all of the Little Verses and Problems, but in all cases the pages are given where such sections of the book begin. In the big Index, Volume 20, you will find every title and every subject, including the pictures.

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Photo, Brown Bros. The Mississippi River Front, Quincy, Illinois.

THE MISSISSIPPI

THE Mississippi River has been called the "main artery" of the United States. Like an artery in a man's body, it pulses through the very heart of the American continent, receiving its water supply from the many tributaries that run like giant veins into every part of our broad land. From the source of its chief tributary, the Missouri, to its mouth is 4,200 miles, making this joint stream one of the longest rivers in the world.

But if you will look in your atlas you will see that the real source of the Mississippi River proper is not with the Missouri in the Rocky Mountains, but in the hill country of Minnesota near a little group of lakes. For a long time Lake Itasca was considered to be the source. There are many lakes in the neighborhood, all connecting, though the reeds and the grass sometimes hide the little streams which join them together. Men who have surveyed the whole park now think that Little Elk Lake, seven miles beyond Lake Itasca, is the real source of the Mississippi. The water passes through Lake Itasca. It is a pretty little lake encircled with green forests, and often the tremulous laughter of the loon drifts over its quiet waters. In certain spots the water is broken by the lush green grass of the rice that pushes its way up from the rich mud bottom. The stream that leaves the lake is no more than a creek about twenty feet wide and two feet deep, which seems to be an unworthy beginning of the mighty river it is to become. The length of the Mississippi proper is 2,460 miles.

As the river pushes on its way it becomes broader and more tranquil, but when it arrives at St. Paul and Minneapolis, the great manufacturing cities of the Northwest, it is still a very moderate-sized stream. At Minneapolis the river takes its first foaming leap over the Falls of St. Anthony, and for a little way the waters become a thunderous, roaring, impressive torrent.

Between the sturdy bulwarks of the Minnesota and Wisconsin bluffs the river makes its way. It is a lovable stream here, clear and swift and cool, unmuddied by the tearing of the banks on the broader river below. Below, the bluffs are wider apart, and the river swings first against one and then against the other. Between the river and the bluffs the land is covered with trees, principally natural forest—oaks, poplars, beeches, elms, maples and willows, with farmhouses hidden here and there among the trees. These houses, on the whole, look prosperous.

In Iowa the beautiful farming country rolls away on either side. At Keokuk a wonderful dam to supply power has been constructed. This is one of the largest dams in the world, though not one of the highest. It furnishes much water power. Between Muscatine, Iowa, and Hannibal, Missouri, hundreds of thousands of acres of rich corn-belt land have been reclaimed by pumps. At Hannibal, beside the growing river, we come to the country of Mark Twain. Here great rugged bluffs rise along the water's edge, and beyond the green, dotted pastures roll away to the hill country inland, where there are farmhouses and churches and patches of forest trees. "The house the humorist lived in still stands and is much the same as it always was—a stumpy, two-story, clap-boarded dwelling." You can find also the "hill where Tom Sawyer and Huckleberry Finn used to dig for treasure with much enthusiasm, expecting to find a brass pot with a hundred dollars in it or a rotten chest full of diamonds."

About twenty miles above St. Louis the Great River receives the water of the Missouri, itself an immense river, and larger than the Mississippi River at the point where they join on their way to the Gulf of Mexico. Soon we see no more of the high bluffs for a time, but the river runs through the flat lands.

From the city of Cairo, Illinois, to the Gulf the river is generally higher than the land which lies away from the stream. It has built a bed and banks for itself out of the vast quantities of mud, sand and silt it has brought down from above.

THE TREACHEROUS CURRENT OF THE RIVER

From here on, the current of the Mississippi is a thing to be reckoned with. "To the landowners of the river valley the waters seem a very demon of destruction, eating away the banks and flooding the low-lying farm-lands, sweeping all before its swift, silent current. In the flood season landholders on the river never know but they may awake one morning to find their fair acres a swirl of thick brown waters. One traveler through the Mississippi Valley says that a hotel proprietor told him there was a 'heap of pretty country under water along the river,' and one day he made a trip to an outlying village to see how the people fared in the submerged districts. They took the flood philosophically enough. He found they were in no danger, simply inconvenienced. Some of the land and houses had not yet been touched, but the majority of the dwellings were quite Venetian, and he hired a negro to row him about among them."

THE DREADED FLOODS AND THE LEVEES TO HOLD THEM BACK

To prevent these devastating floods the people have built up levees—great earth walls—all along the banks to keep the giant river back within its natural bounds. Along these levees roadways are built in some places, and back of them pleasant homes, neat and cozy and clean, with vines and shrubbery and shade trees growing about them. Sometimes the river rises above the levees, or one of them breaks, and then the whole face of the earth is covered with water.

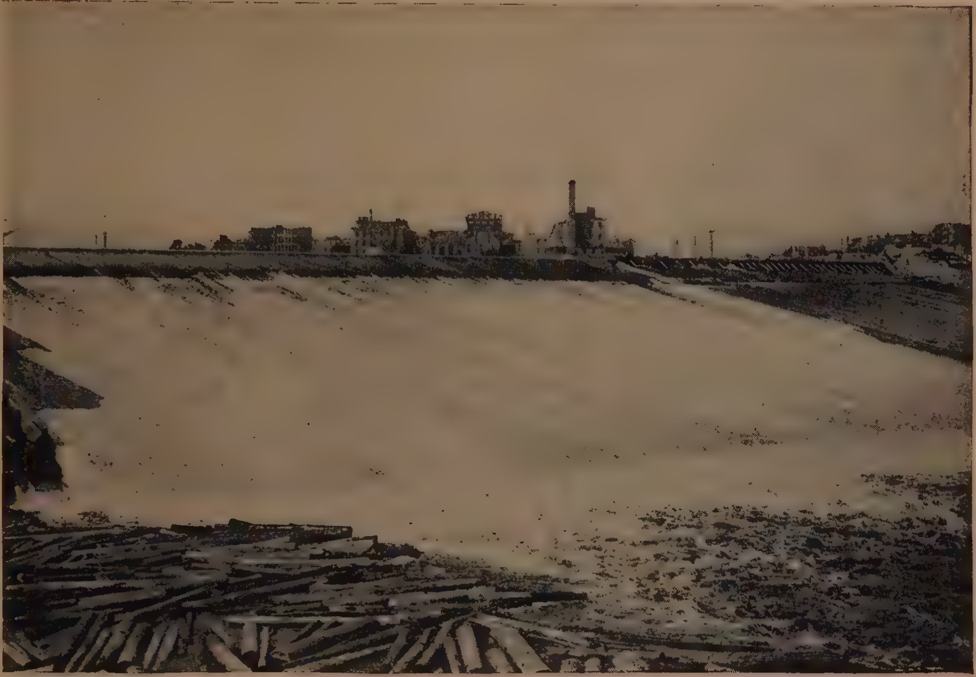
To one class of the Mississippi people, however, the floods hold no terror—the boat-dwellers. For them the river is a great ever changing highway, a bountiful fairy dream full of change and fascination. From the logs afloat upon its surface they gather the wherewithal to build their homes. All the way from St. Paul to New Orleans thousands of the water gipsies can be found, in all sorts of houseboats, varying in size and material according to the means or whims of the owners. Some of them are no larger than an ordinary skiff, with hooped-iron roofs covered with canvas, under which the people crawl for the night; others are large, comfortable and attractive. Sometimes they can be seen in flotillas of a score or more; at other times only two or three can be seen.

WHERE THE OHIO JOINS THE RIVER

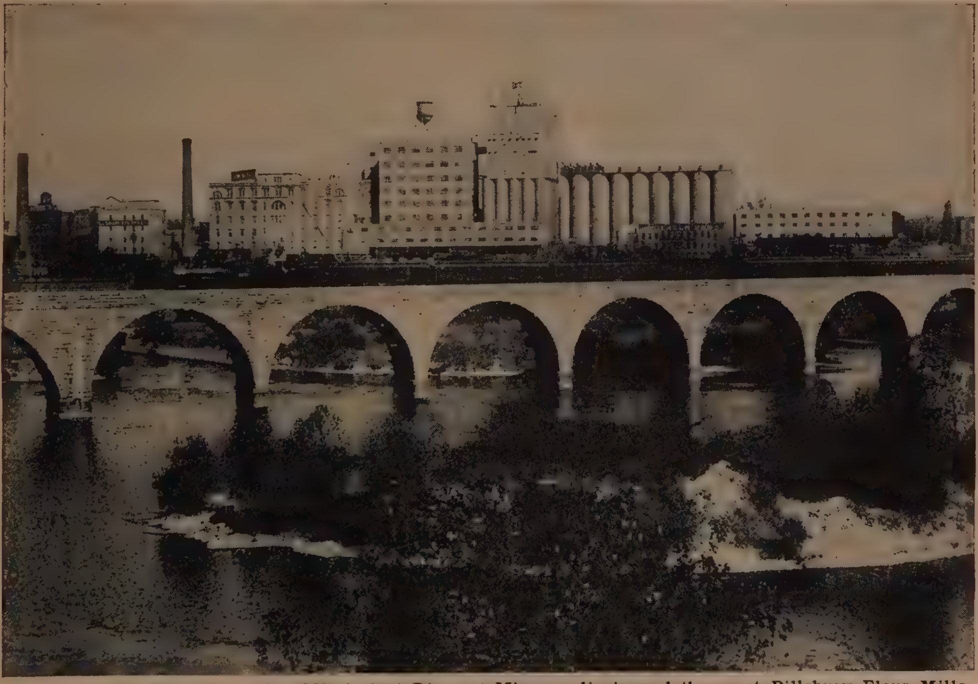
Cairo stands where the great Ohio River from the east joins the Mississippi, and no end of steamers, scows, rafts, tugs, houseboats and skiffs float up and down. With such towns as this the river banks are studded. The air is filled with a sort of lazy hum of life and excitement. The Ohio carries down much water, and it, too, is subject to floods. It brings water down from the western slopes of the Alleghenies, and often raises the level of the Mississippi itself.

Kentucky first, and then Tennessee,

MINNEAPOLIS AND THE MISSISSIPPI



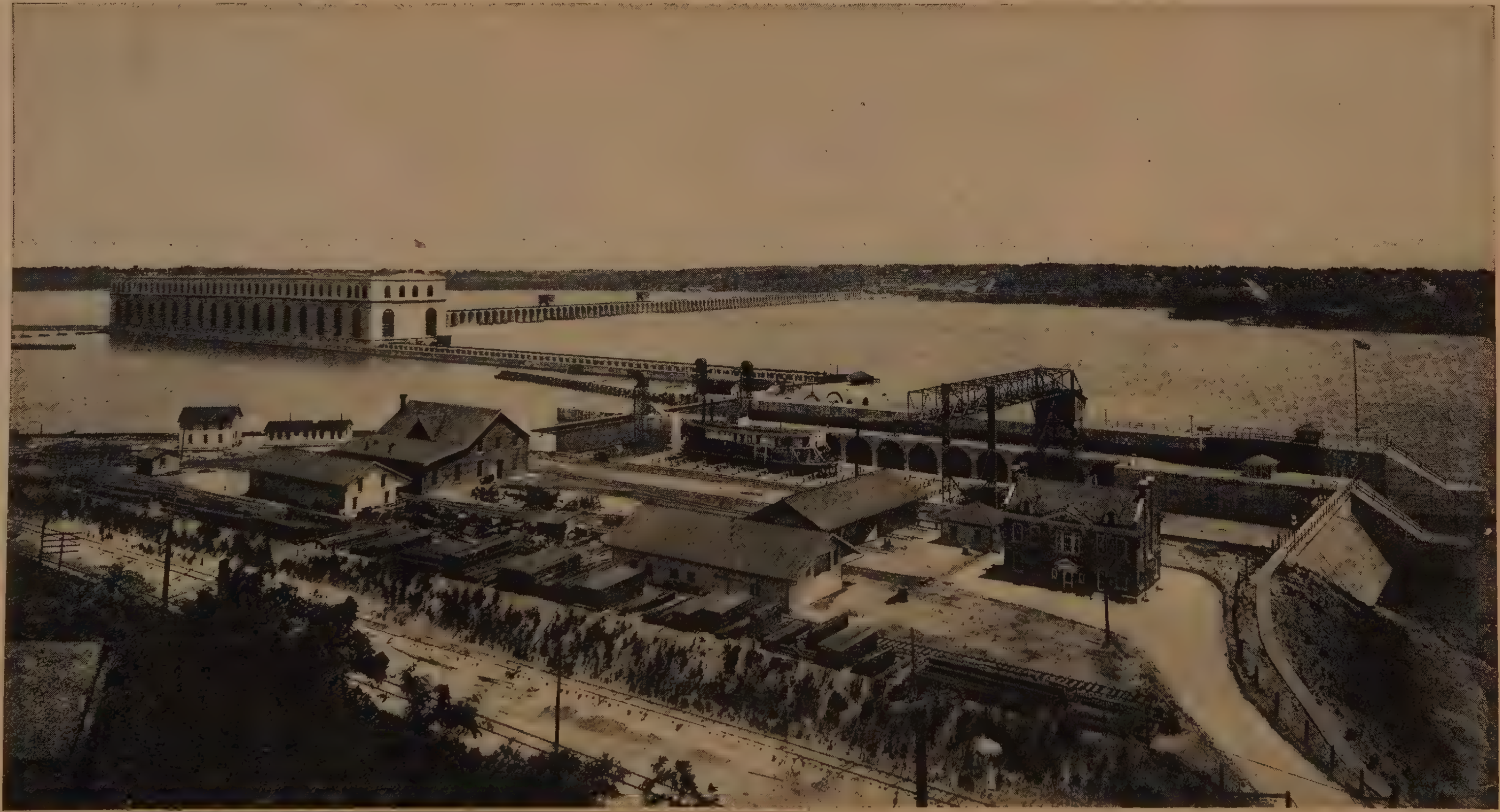
The Falls of St. Anthony at Minneapolis, where the river pitches down falls and rapids with a declination of eighty feet in half a mile. Here the Mississippi enters a channel between sandstone bluffs.



Here we are looking across the Mississippi River at Minneapolis toward the great Pillsbury Flour Mills, which are that city's boast. Between the twin cities of Minneapolis and St. Paul the Federal Government built a power dam which permits packets to move from St. Louis to Minneapolis.

Photos pages 5655, 5657 and 5658 by Ewing Galloway.

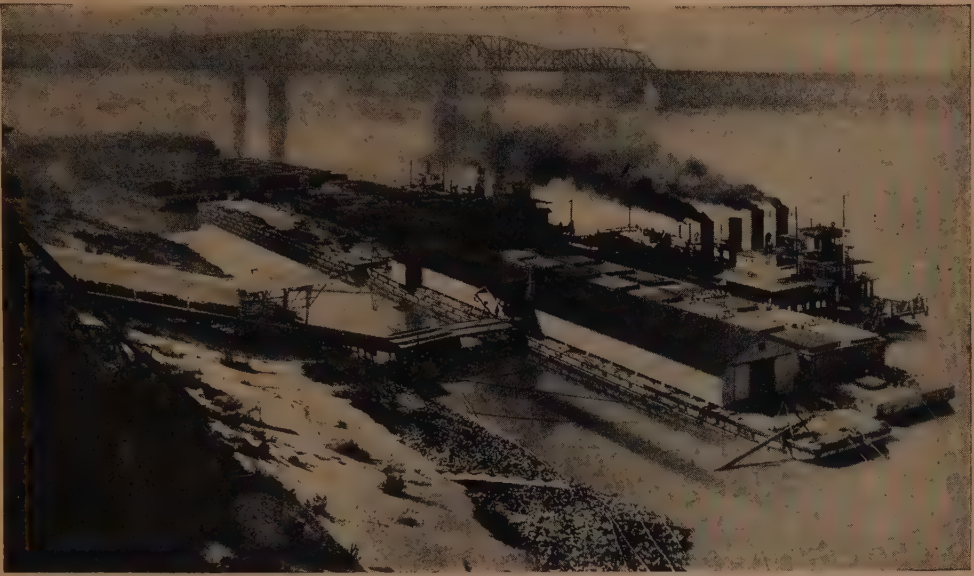
WHERE THE MISSISSIPPI IS CHAINED AND SET TO WORK



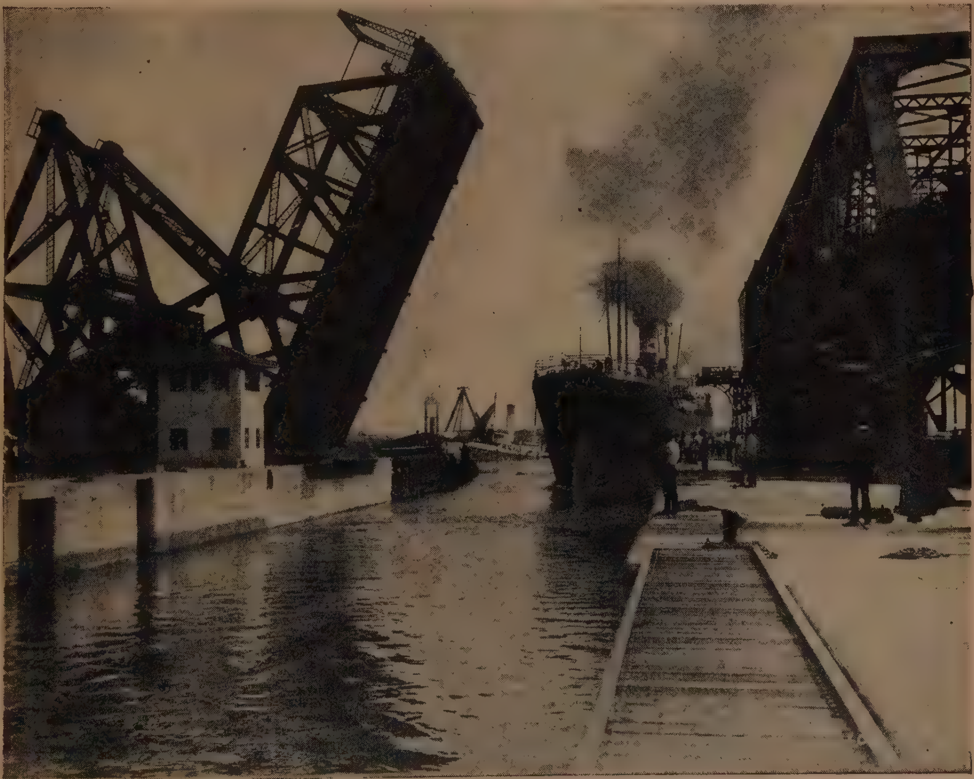
Photo, Anschutz.

At Keokuk, Iowa, the course of the Mississippi, now grown to be a large stream, is checked by one of the great dams of the world, though not one of the highest. From the Illinois shore in the background the concrete dam stretches over four-fifths of a mile to the power house in the centre, and then turns downstream toward the locks you see to the right, through which vessels may pass. The plant can deliver 120,000 horse power, and it will be possible to increase this amount considerably.

THROUGH TENNESSEE AND LOUISIANA

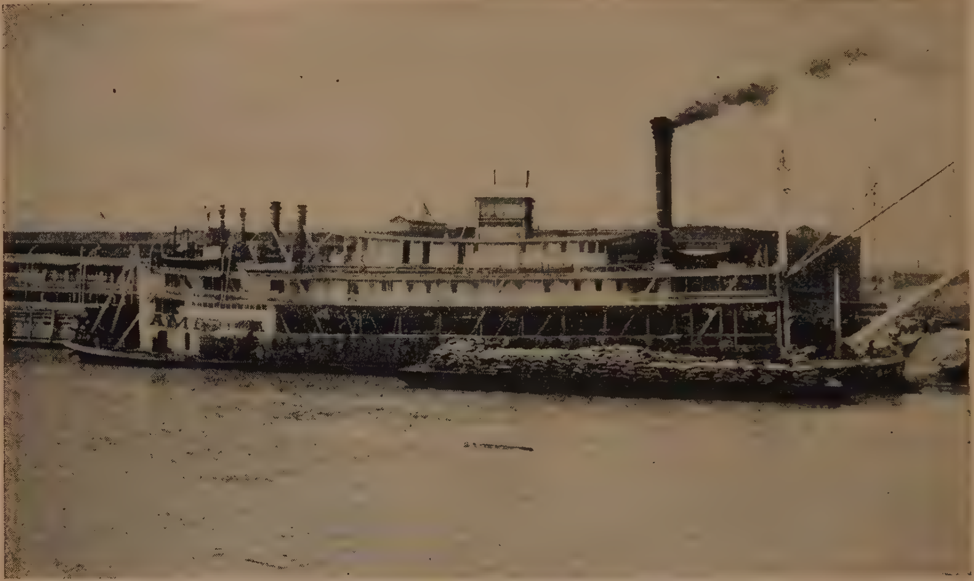


At Memphis, Tennessee, the ten trunk lines which enter the city converge in the municipal and rail terminal shown in our picture. This is one of the busiest ports on the river.

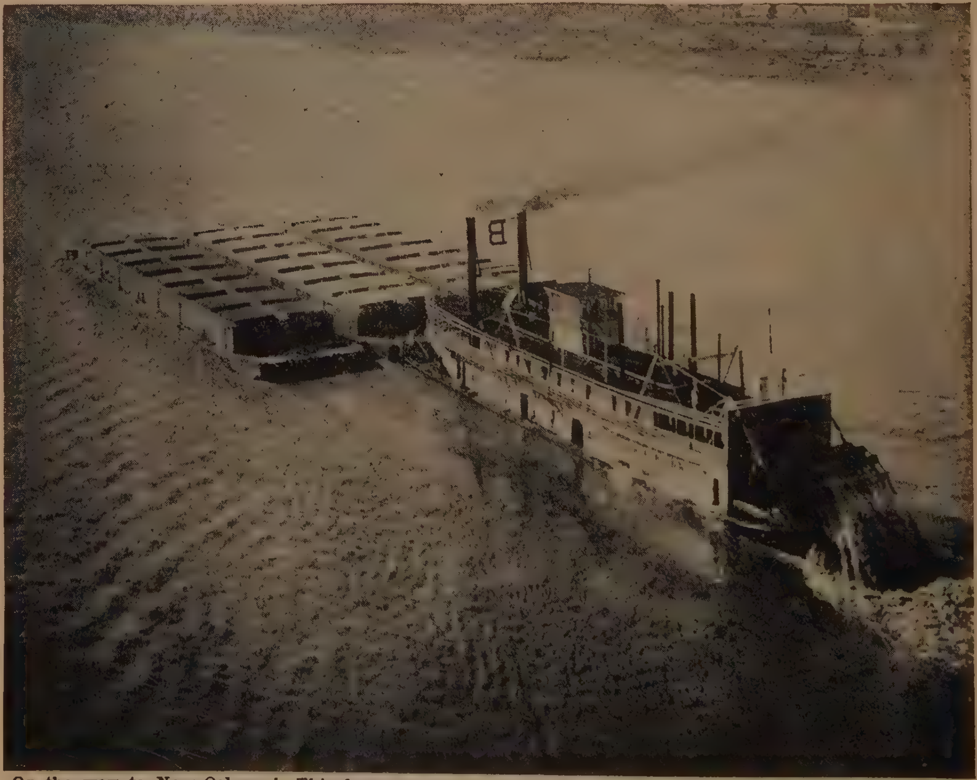


Connecting the Mississippi River with Lake Pontchartrain, five miles from New Orleans, a large ship canal has been built. Here we see a ship passing through a drawbridge on its way from the lake to the river. This short cut saves many miles of travel.

NEW ORLEANS OR BOUND THERETO!



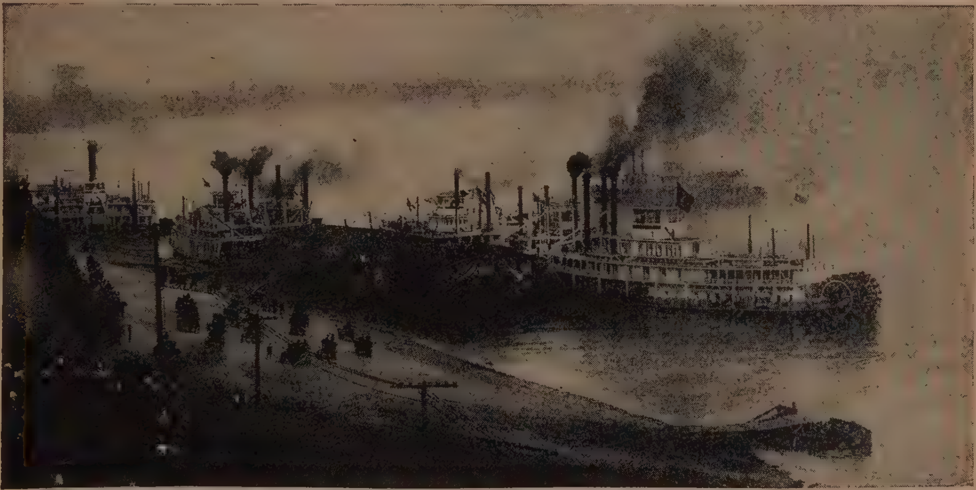
Our picture shows us a view of the New Orleans water front with barges being loaded with cotton and rice. This queen city of the Mississippi is the greatest cotton port in the world and gives employment to hundreds of thousands of people.



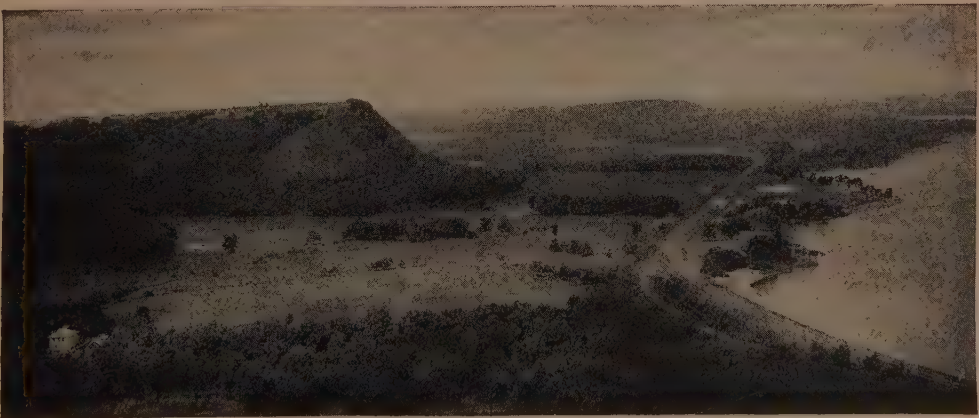
On the way to New Orleans! This barge convoy is on its journey from St. Louis, where it took on a load of wheat for export. Notice the cascade over the rear of the river tug as the paddle-wheel is in full action. This type of vessel is quite common on the river.

THREE VIEWS OF THE MIGHTY MISSISSIPPI

In order to interest the National Government in the construction of a deeper channel in the Mississippi River a great excursion carried President Roosevelt and other prominent men to see the situation.



Though the Mississippi is long, yet it is not deep. In some places it is so shallow that a special type of boat has been constructed with the paddle-wheel at the back as a protection against snags.



Here we see Lake Pepin, formed by the widening-out of the river, seventy-seven miles below St. Paul. We see also the high bluffs which are common to the upper course of the river. Photos, Brown Bros.

are on the east bank, and Missouri and Arkansas on the west. In Tennessee wide expanses of corn- and cotton-fields stretch away from the waters. In some seasons of the year the fields are alive with negro workers hoeing the corn and cotton or picking the white fluff balls out of their round bolls. In the autumn, when the bolls open, the cotton lands along the Mississippi look as if they were white with a fall of snow.

As the river flows lower and lower in its course the volume of its broad waters grows greater and greater. It washes away hundreds of acres of plantation lowland every year.

Along the lower reaches of this river, the banks become farther and farther apart, until to people standing upon one bank the other seems but a hazy line of blue across the swift, turbid waters. In the fall the broad stream is alive with river schooners piled high with blue molasses barrels and bales of cotton. Seen in the hot sun against the clear sky, the cotton-piled steamers seem like floating mountains of white snow. In the forecastle of the boats can be seen the throngs of negro workers, the handkerchiefs bound about their heads flaming gaudily against the snowy background of the cotton bales.

THE GREAT HIGHWAY ALONG WHICH THE BOATS PASS

The army engineers are constantly struggling with the river. In some places it is too wide to give a safe passage for steamers, and here they narrow it. They build levees to keep it back, they strengthen banks to keep the river from eating them away. The Mississippi levees are now completed to standard height and width for about five hundred miles. It is hoped by continuing this work to avoid a repetition of the disastrous floods that have created havoc.

The last part of the journey is through a region almost tropical in appearance. The river twists along, and from the upper deck of a boat paddling downstream one may see the variegated water birds in the swamps behind the levees, and tall cypress trees festooned with Spanish moss waving in the breeze and rising out of a real jungle of undergrowth. It is like another country.

As the river nears New Orleans houses suggestive of thrift and prosperity spring up along the shore, and pretty white villages nestle among the tall trees. Here and there can be seen whitewashed beams and sheds, negro cabins and hen coops, with broad sugar- and rice-fields rolling away behind them.

NEW ORLEANS, "THE CRESCENT CITY," AND THE RIVER

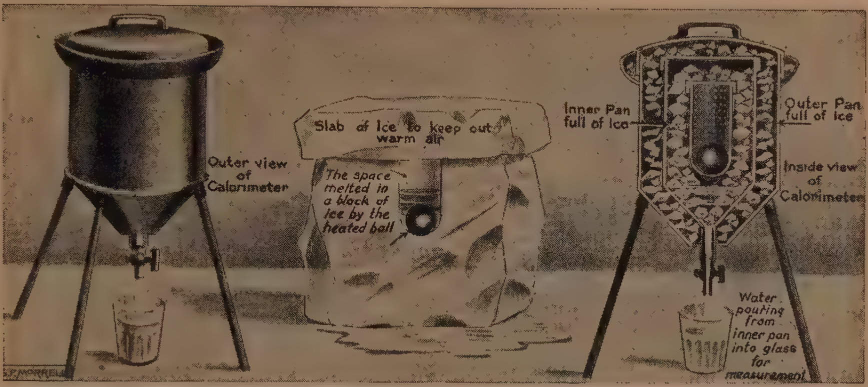
At last the great river curves around the high-built levees and wharves of New Orleans, "the Crescent City." Like New York, New Orleans is one of the great commercial gateways of our continent. Even the river itself seems dwarfed by the monster steamers that plow its "dun waters." Old, bulky ferry boats, huge river dredges, and fruit vessels from the West Indies, Mexico and South America make their way to and fro; and in and out among them all push the slim white Mississippi packets, looking like giant swans upon the turbid waters.

"Some classes of goods go at once into the warehouses, trains or vessels, but others are stacked for a longer or shorter time on the wharves. There are vast quantities of great, clumsy cotton bales, rows of oozy molasses barrels, heaps of raw sugar in coarse brown bags, piles of lumber, great, odorous hogsheads of tobacco, and boxes and crates and bales of a thousand shapes and a thousand variations of contents. But cotton is more important than anything else, for New Orleans is the greatest cotton port in the world, and the storing, selling and handling of this product furnishes a livelihood to the majority of the city's 300,000 inhabitants."

Five miles from the Mississippi at New Orleans is a large salt-water lake, Lake Pontchartrain, which flows through Lake Borgne and Mississippi Sound into the Gulf of Mexico. Canals to the heart of New Orleans enable vessels to make a short cut through the Lake to the Gulf.

The city has nearly 400,000 people now. It is not at the end of the river, for the city is many miles from the mouth, or mouths. The river sweeps on, without heeding the great traffic of the Crescent City, and empties its silt-laden waters into the Gulf of Mexico lying placid and deeply blue against the southern sky. The "Great River" builds its mouth out far into the open Gulf, dropping the silt it has carried as it meets the salt water of the sea.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 5789.


Outer view of Calorimeter
Slab of ice to keep out warm air
The space melted in a block of ice by the heated ball
Inner Pan full of Ice
Outer Pan full of Ice
Inside view of Calorimeter
Water pouring from inner pan into glass for measurement
F. MORRELL

These pictures show the outside and the inside of a simple calorimeter, which measures the quantity of heat in a thing as a thermometer measures its level of heat. The amount of heat is shown by the quantity of ice melted. The middle picture explains how the instrument works.

HEAT AND TEMPERATURE

THERE are many important facts for us to learn about heat in addition to those we have already considered. The general rule is that when heat is given to a certain quantity of anything, or taken from it, its temperature changes. We might expect that this would always happen—that we could not add heat to a thing without making it hotter, or take heat from a thing without making it colder.

Yet it is easy to prove that this is possible, and also that it does not contradict in the least the law that no kind of energy can be lost and that all must be accounted for. If we take ice at the melting-point and add heat to it, we do not raise its temperature; or if we take water at the freezing-point, with a very small piece of ice in it, we can take heat from it, yet its temperature does not fall; or if we take a mixture of ice and water, we can add heat to it or take heat from it without altering its temperature.

Lastly, if we take liquid water at the boiling-point in the open air and add any amount of heat to it, not too rapidly, we make it no hotter. The liquid water disappears and takes the form of water-vapor, which is itself no hotter than the liquid water was.

All these are illustrations of what is called *latent heat*. What is true of water is true of other things. Now, what we notice in every one of these illustrations is that, though the temperature of the water is not changed, its state is. In one case we have ice turning into liquid water; in another we have liquid water turning into ice; in yet another case we have liquid water turning into water-vapor.

Here is the proper definition of latent heat; though it is rather long, it is perfectly clear: "Latent heat is the quantity of heat which must be communicated to a body in a given state in order to convert it into another state without changing its temperature."

That is exactly what these examples illustrate. The heat seems to have disappeared as heat when we put it into ice and turn the ice into liquid water no hotter than the ice was, and so we say that it has become *latent*, using the Latin word meaning "lying hid."

The opposite term to latent heat is *sensible heat*. Here the word sensible is used in its proper meaning, and a thing is called sensible because it can be sensed, or felt. So, when we give heat to a thing and make it warmer we call it sensible; but if we give heat to a thing and make it no warmer we say that the heat becomes latent. We must understand that if the heat does not make the thing warmer it must change the state of the thing; the heat has to be accounted for in any case. We may quote the simple language in which Lord Kelvin, the great master of this subject, explains the right meaning of the words sensible and latent heat.

THE HEAT WHICH BECOMES HIDDEN IN A BASIN OF ICE AND WATER

"When heat given to a quantity of water warms it, the heat becomes sensible to a hand held in the water. When a basin of warm water and a basin of water and ice are placed side by side, a hand dipped first in one and then in the other perceives the heat. If now the warm water be poured into the basin of ice and water, and stirred for a few seconds of time—unless there is enough of warm water to melt all the ice—the hand perceives no warmth: on the contrary, it perceives that the temperature is the same as it was in the basin of ice and water at the beginning. Thus the heat which was sensible in the basin of warm water has ceased to be sensible in the water that was in that basin, and has not become sensible in the other. It is therefore well said to have become latent."

The facts of latent heat give us a means of measuring heat itself, for we can measure the amount of ice that can be melted into water without change of temperature, and the more ice that is so melted, the more the heat that is employed. It does not matter in what form the heat is applied, we can measure it equally well. A given quantity of ice may be melted into water of the same temperature, either by being exposed to a great deal of warm water or to a little very hot water. We know that in each case the amount of heat there must have been the same, because it does the same work, turning the same amount of ice into ice-cold water.

THE AMOUNT OF HEAT IN A THING IS NOT THE SAME AS ITS TEMPERATURE

The old name for heat when it was supposed to be a fluid was *caloric*, and the name for the instrument that measures heat is *calorimeter*. We must never mistake the absolute difference between a calorimeter and a thermometer; the one measures the *quantity* of heat, and the other measures its *level*.

We are, nowadays, accustomed to call a fixed quantity of heat a calorie, and that will help us to remember the word calorimeter. When we say latent heat we mean heat itself; when we talk of summer heat we do not really mean heat itself, but the temperature, or heat-level.

Two famous Frenchmen, Laplace the astronomer and Lavoisier the chemist, invented the first calorimeter, which measured the amount of heat by the amount of ice melted. Another method might be employed. When ice is turned into ice-cold water, heat becomes latent; but heat becomes latent also when boiling water is turned into water-vapor, and so it is possible to make a calorimeter depending on measuring the amount of water evaporated by heat.

We can also measure the amount of heat, without any reference to latent heat at all, by taking water or some other substance at a fixed temperature and noticing how much a given quantity of it has its temperature raised.

WHAT HAPPENS TO THE HEAT WHEN ICE TURNS INTO WATER

When we come to consider the doctrine of latent heat in the light of our modern knowledge of matter, we see that, though the term is worth keeping, it is rather misleading. The truth is that, when ice is turned into ice-cold water by putting heat into it, the heat which disappears is really turned into something else—something else that makes the difference between liquid water and ice. This something else is the motion of the molecules of the liquid water; and what has happened is that the heat motion has been turned into that motion on which the liquidness of the liquid water depends.

In the same way, when boiling water is turned into water-vapor of the same temperature, and when we say the heat has become latent, what we really mean is that the heat motion has been turned into another kind of motion—the motion of the molecules making up water-vapor. We know that all gases, including water-vapor, consist of molecules in very rapid movement. Part of this we must suppose to be the special kind of movement called heat, and of this there may be less or more, because a gas may be hotter or colder.

There is another very important phrase,

specific heat, which we must study. If we take a given quantity of water and a given quantity of something else, both at the same temperature, and put a certain amount of heat into them, we find that the something else, whatever it is, becomes hotter than the water does. The only exception to this rule is hydrogen gas. Apart from hydrogen gas it is true that in order to make water hotter we must put into it more heat than into any other substance. For convenience we call the specific heat of water 1, and then the specific heat of all other substances, except hydrogen gas, is less than 1.

WHY THE SAME AMOUNT OF HEAT MAKES ONE THING HOTTER THAN ANOTHER

The chemists have discovered certain remarkable laws about the specific heat of different things. It is not a matter of chance that the same amount of heat given to the same amount of copper and iron, at the same temperature, will not raise the temperature of each in equal degree.

We find that the specific heat of a substance depends to a great extent on the size and weight of the atoms of the substance. If an element has big and heavy atoms, there will be fewer of them required to make up the given weight of that thing, say, an ounce, than will be required to make up the same weight of another element which has smaller and lighter atoms. In other words, the bigger the atoms are, the less heat will be required to raise the temperature to a given degree. The scientific way of saying this is that, as a rule, the specific heat of a thing is *inversely proportional to its atomic weight.*

THE REASON WHY THE TEAPOT KEEPS HOT SO LONG

The very high specific heat of water has important consequences in practical life, and this is one of the most valuable properties of this wonderful compound. If we made tea with any other liquid than water, we should find that the tea got cold far more quickly than usual. The fact that water has such a high specific heat means that it will hold a lot of heat. The amount of heat in a given quantity of boiling water is greater than in the same quantity of anything else at the same temperature, because the specific heat is higher. This means that if we wish to boil cold water we have to put more heat into it than we should have to put into anything else, and it also means that when we have got the water boiled it takes a long time for the hot water to cool.

All this means that water stores up heat better than other things, and this is as true of a full teapot as of the ocean. This is the explanation of an island climate such as that of Japan or the British Isles. The water surrounding them could not do what it does except for this high specific heat of water and its low conducting power.

This means that in the summer water will swallow up enormous quantities of heat, and this heat collected in summer can be given back to moderate the climate in the winter.

This must conclude our study of heat. It is a subject about which too much cannot be known, because of its practical importance in relation to all kinds of machinery, and also because of its great bearings on our ideas of the universe, and the history and destiny of things in general.

THE IMPORTANCE OF THE LAWS OF HEAT TO ALL KINDS OF MEN

There is perhaps no other subject in the world which so directly concerns the man who wishes to save in the working of his factory or his motor car, or the pure philosopher who wants to know the laws and course of nature. That is why one of the greatest of all the achievements of the nineteenth century was the discovery of the nature and laws of heat, unknown to all preceding ages.

The discovery of these laws is of enormous daily importance to every one of us now, and it furnishes the proof of that greatest of all scientific ideas,—the truth that while all things can be changed into other things, while all forms of power can be changed into other forms of power, nothing is made out of nothing, nor is anything ever destroyed.

This greatest of all scientific truths, the law of the conservation of energy, was seen, as by the eye of the prophet, by the earliest thinker of whom we have any record, and has played a part in the history of the human mind for twenty-five hundred years. But the proof of it was not obtained until the nineteenth century, when many devoted men of science were able to remove all the remaining doubts.

THE NEXT STORY OF THE EARTH IS ON PAGE 5807.

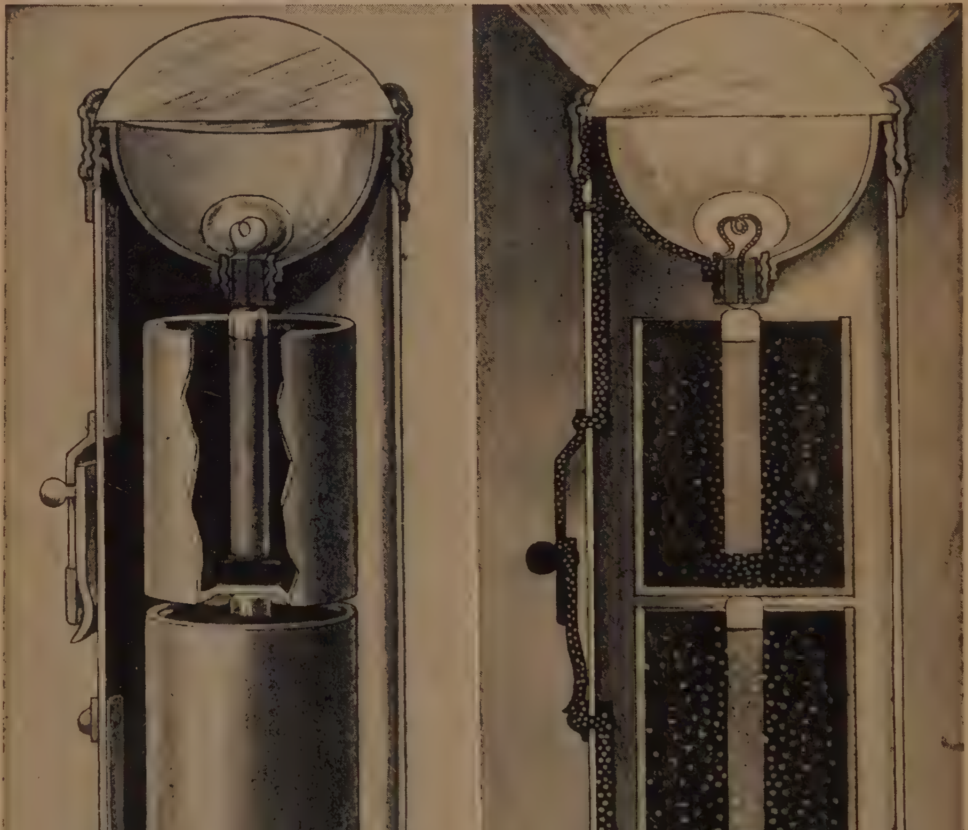
HOW YOUR FLASH-LIGHT WORKS

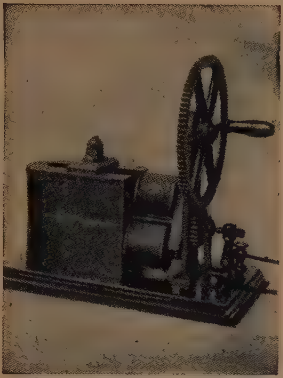
A SIMPLE FORM OF CELL

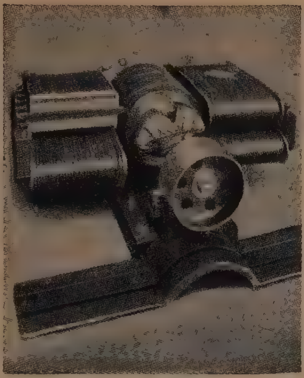
LECLANCHÉ CELL

DRY CELL

Here we see three types of electric cells. The first is a simple form of cell, in which energy is produced by chemical action. A zinc plate and a carbon plate, connected by a wire, are standing in a jar of sulphuric acid. The acid eats into the zinc and liberates hydrogen, which drifts across the liquid to the carbon plate, as the upper arrow suggests. The ions of hydrogen travel from zinc to carbon, and start an electric current flowing in this direction, which causes electrons to crowd upon the connecting wire; these electrons set up a continual circulation of electricity as long as the carbon and zinc are joined together. In the Leclanché cell sal ammoniac takes the place of sulphuric acid. In the dry cell the zinc case takes the place of the zinc plate and the carbon is surrounded by manganese dioxid in a paste of sal ammoniac.


In a flash-light a number of cells are connected to form a battery. The wire connecting the two ends of the battery is represented by the filament in the lamp and by two metal strips, one attached to the zinc of the bottom cell, and the other to the metal cup into which the lamp is screwed. In the left picture the switch is off, but as soon as it is brought down to the lower metal bolt, as seen in the right picture, the circuit is completed. Then the electrons flow from one cell to the next, along the metal strip, along the delicate filament in the lamp, and cause the filament to become white hot. Then we have a bright light.


One of the first dynamos.


A later dynamo.

A modern dynamo.

THE STORY OF ELECTRICITY

THE first kind of electricity that was known was the kind produced by friction. In ancient Syria the women often used for their spinning distaffs made of amber, and the spindles, as they ran merrily round, would often touch against the garment of the spinner and become electrified. When placed on the ground they would attract dry leaves or dust, which would cling to them with a mysterious force.

All unconsciously these spinning-women were driving an *electrical machine,* making the electricity which thousands of years later was to light our homes.

About three hundred years before the birth of Jesus, one of the early philosophers of Greece, Theophrastus, found out that some unknown force must be at work when amber was excited by friction. Theophrastus found that amber was not alone in this power but that it was possessed also by a mineral called tourmaline. Pliny, seventy years after Christ, again drew attention to these things, and followed up the early studies of Theophrastus.

Aristotle tells us how the "torpedo fish" would benumb both men and fishes. This curious creature has an organ with which it produces electricity, and by merely touching it, it can benumb another fish with a powerful shock. The electric eel has similar powers; in fact, several varieties of these remarkable fishes are now known. These electric fishes were actually used to give shocks to people suffering from gout, as a cure, probably with very doubtful results. Yet such crude attempts to use the yet-unknown forces of electricity were the beginnings of the vast electro-medical science of to-day.

Electricity owes its name to amber, the earliest substance known to show the property of attraction. On page 1244 we read about Dr. Gilbert, the man who first used the name.

Very little more was heard of electricity throughout the whole of the Middle Ages. A few facts were handed down to history, but were of little importance. Eustathius told of a philosopher who, while dressing and undressing, would at times emit crackling sparks, flames blazing from him without burning his clothes, but it was nothing more than electricity such as we get from stroking a cat on a frosty day. The old philosophers saw lightning without thinking of electricity; they looked upon it as a little flame falling from heaven.

Homer, in the Odyssey, described the sulphurous smell that follows lightning, due to the electrified air giving us ozone—a natural process that we copy to-day for purifying the air of subways or railways and large buildings. But everyone groped in the dark through the centuries for the real power that was to revolutionize the world, until the real beginning of electricity was made by Dr. Gilbert, of Colchester, England, toward the end of the sixteenth century.

This distinguished physician repeated the experiments that history had recorded with amber. Then he undertook to find out what other substances would become electrified when rubbed. Suspending a fine needle by a piece of silk, he held the rubbed object near it, and observed whether it attracted the needle. In this simple way he discovered that many substances could be electrified by friction, and he drew up a list of what he called "electrics," or substances with which electricity can be produced.

ROBERT BOYLE FOUND THAT ELECTRICITY CAN BE STORED

Robert Boyle, who lived from 1627 to 1691, now set himself to find the origin of electricity. We may look upon him as being the first man to discover that electricity can be stored. For he found that a piece of amber, when it had been rubbed, did not immediately lose its powers, but that the charge of electricity remained upon its surface for some time. The importance of this simple observation has become immense to-day, for no force is of use to man unless it can be stored and used in the form required.

These little experiments had shown that the new force could exert power—the power of lifting. A contemporary of Robert Boyle next showed that the mysterious force could produce light. This was Otto von Guericke, who cast a ball of sulphur in a glass bowl, broke the glass, and, extracting the sulphur ball, mounted it on a spindle. When it was rapidly revolved and the hand held against it, the rubbing, or friction, caused it to glow in the dark. The first electric lamp had been made.

THE THREE ENGLISHMEN WHO HELPED FORWARD OUR KNOWLEDGE

Three Englishmen next come into prominence: Newton, who made pieces of paper leap about in the air by an electrified glass; Hawksbee, who made many new discoveries about the attraction of electrified bodies; and Stephen Gray, who made the important discovery in 1729 that certain substances would *conduct*, or carry, electricity, while others would not. Without conductors and non-conductors we could do none of the things we do with electricity to-day. Look at the telegraph wires alongside the railway track as you go along in the train, and on each pole you will see glass or porcelain insulators. Glass and porcelain are non-conductors, and when carrying the copper or galvanized iron telegraph wires they prevent the electric current from escaping.

THE ELECTRIC CURRENTS THAT WERE LOST ALL TOO QUICKLY

The turning-round of a glass cylinder or disk and rubbing it by something to cause friction was really the primitive electric machine. But the currents were lost so quickly that men tried to devise some way of storing them. Various attempts in this direction led to the discovery of the Leyden jar, and of this discovery we read on page 1246.

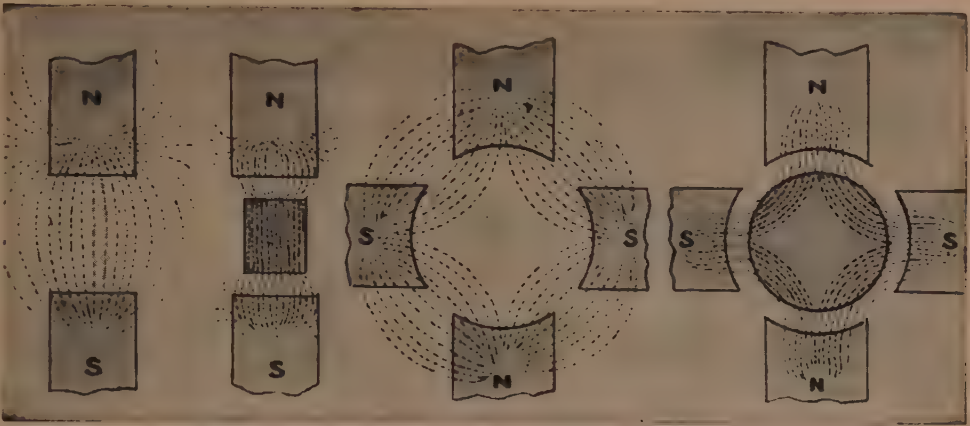
The mysterious force that was to transform the world had been made by *work*, or friction; power had been turned into electricity.

THE MAN WHO WORE TWO PAIRS OF STOCKINGS, AND WHAT HE FOUND

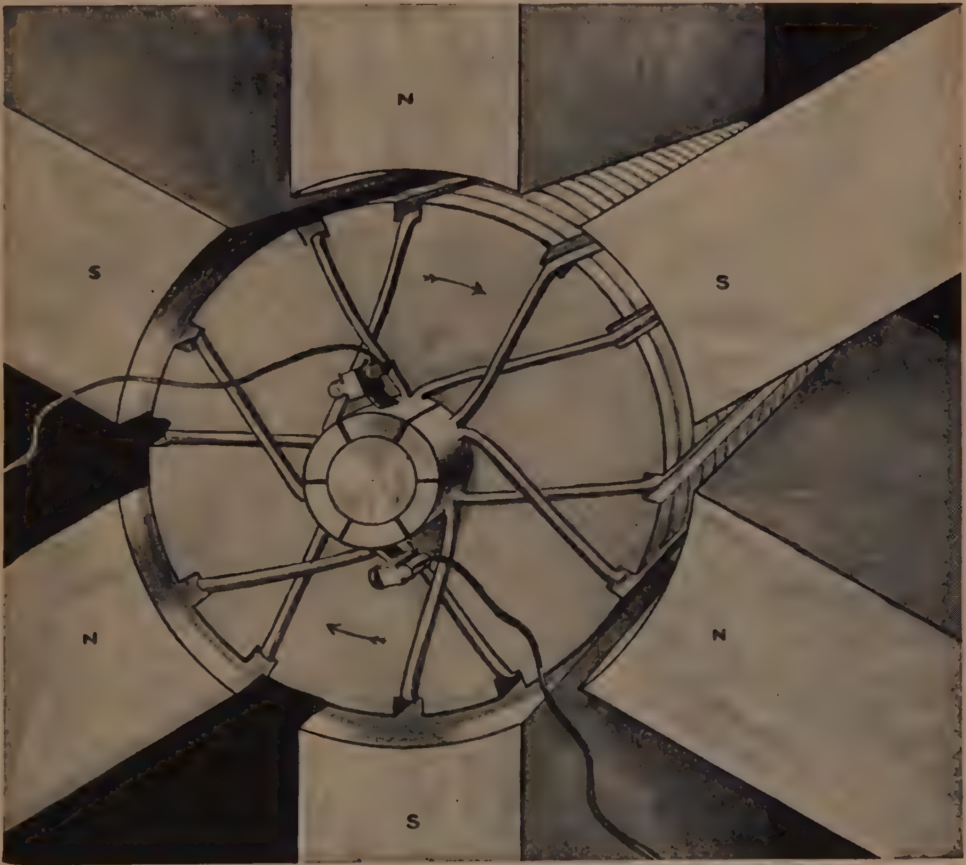
This force could now be conveyed from one spot to another by means of conductors. Some substances would not conduct electricity, and by making use of such substances the new force could be kept apart; while by storing it in a Leyden jar standing on some non-conducting substance, the power could be accumulated and then discharged when it was required.

To Symmer must be given the credit of having first discovered that there are two distinct kinds of electricity—positive and negative. Putting two stockings on the same leg, one black and presumably woolen, the other white and of silk, Symmer found that when he drew them off, drawing the white one off from the black one, the friction charged each one with electricity, but of a different kind. Each stocking stood up as if blown out, owing to its charge, and showed the shape of the leg.

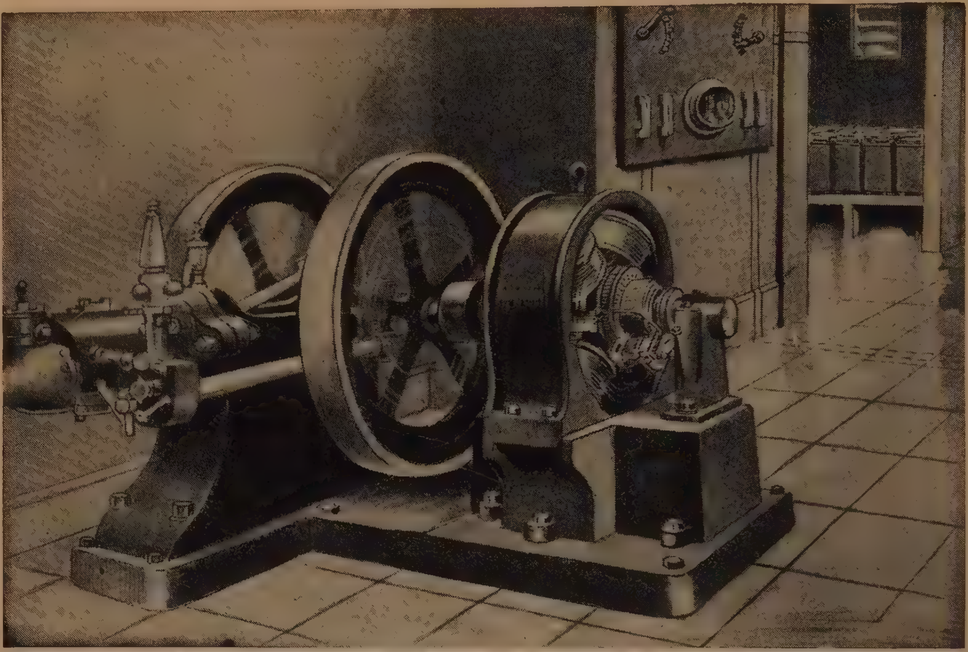
If brought together, the two stockings collapsed, because the two different kinds of electricity neutralized each other.



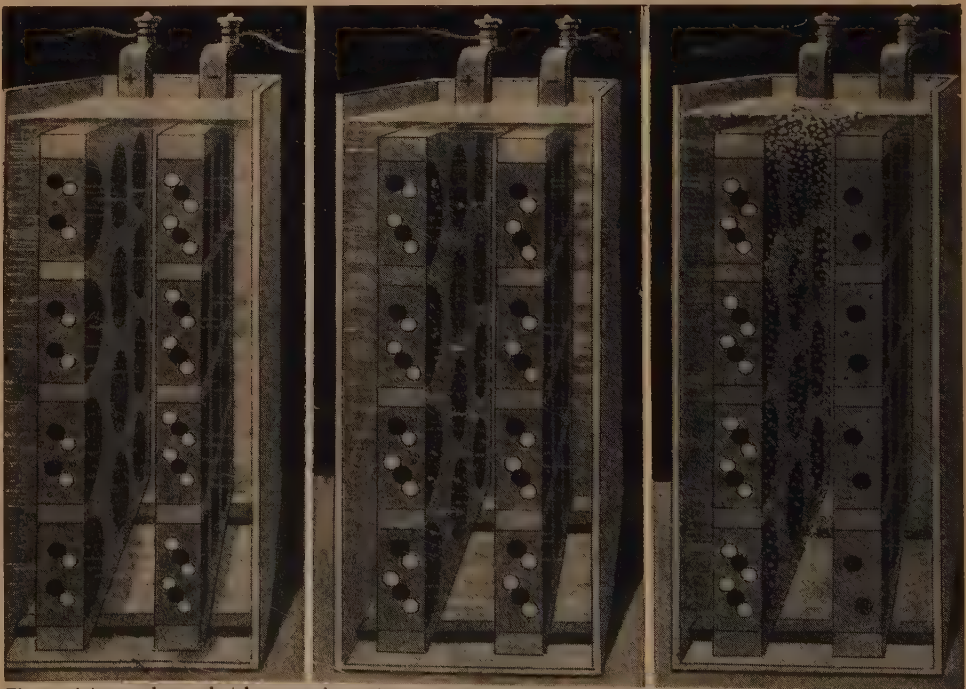
A magnet gives off "lines of force," and these diagrams suggest the lines of force passing from the poles of magnets. The first shows the lines as they pass with air between opposite poles; the next with air and a piece of soft iron between them; and the third as they pass when four magnets are used. A wheel going round in the centre of these four poles, as seen in the last diagram, picks up electricity by cutting through the lines of force, and this is the principle of the dynamo.



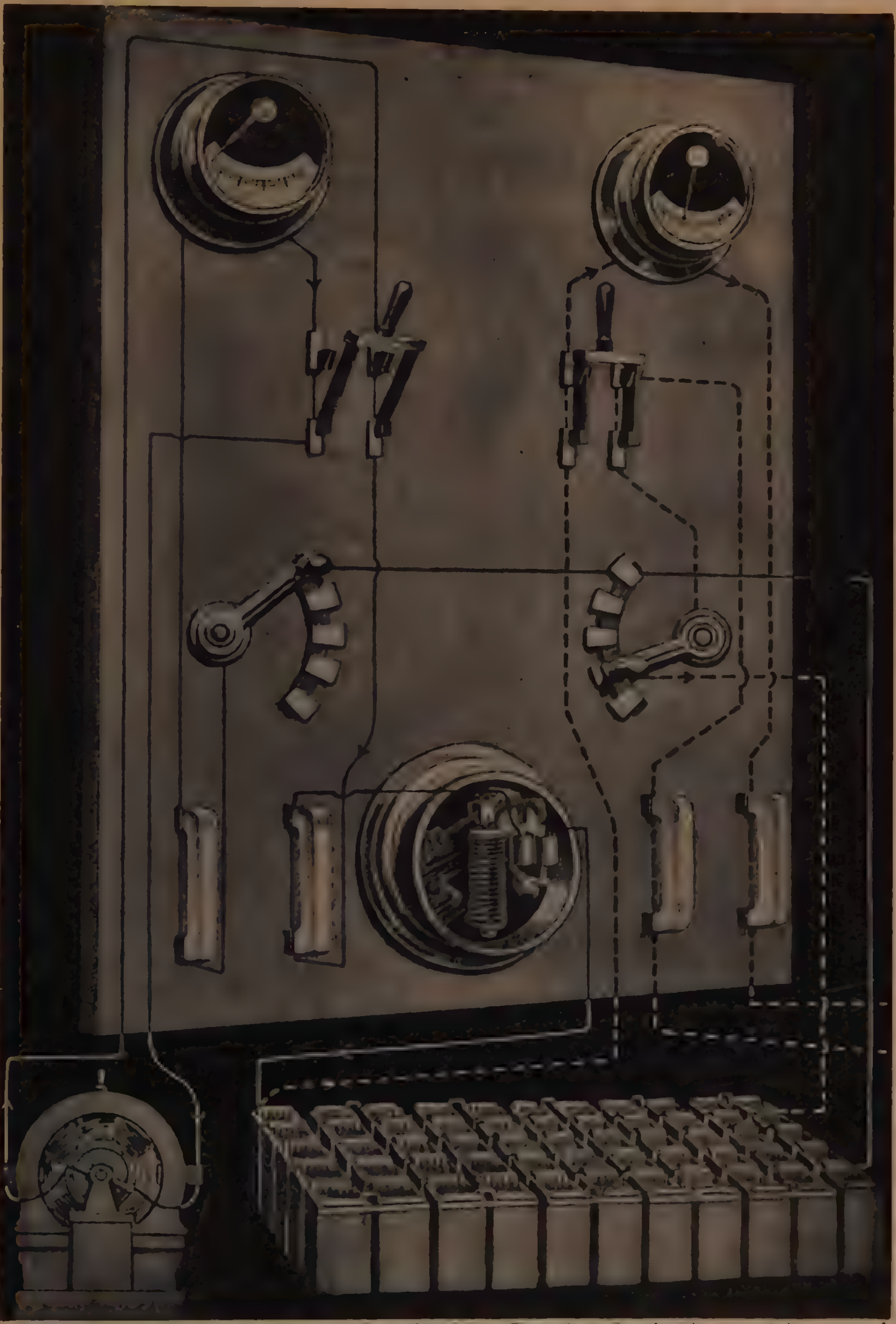
This diagram helps us to understand what happens in a dynamo as seen in the next picture. When a coil of wire is set revolving so as to cut through the lines of force passing from the magnets there is developed in the coil an electric current. A dynamo consists of rings of copper wire wound on an iron core, which revolves between the fixed poles of magnets and so cuts through the lines of force. The core with the coils of wire drawn tightly over it is known as the armature of the dynamo, and here our artist suggests an armature between six magnetic poles. Carbon brushes fixed to the dynamo press against the revolving core and pick up the current, which is carried off, by the wires attached to the brushes, to the mains for distribution wherever it may be required.



This picture shows a complete modern small dynamo. To the right is seen the armature, between large and powerful magnets. Such an armature has an enormous number of coils, and as they fly through the invisible lines of magnetic force an electric current is created in them. The armature is driven round rapidly by the engine on the left.



These pictures show what happens in a storage battery. In each cell are two plates of different material and properties. As the current from the dynamo flows into the cell certain chemical changes take place in the plates and in the liquid, and when the charge from the dynamo is complete the liquid has, by mysterious processes that are not well understood, become a storehouse of electricity. The black and white spots on the plates are meant to indicate the properties that are so strangely transferred. When the cells are discharging their current the chemical action is precisely reversed.



A switchboard is necessary for the control of electricity. Through it the electric current is measured, regulated, distributed and switched off and on. This picture-diagram shows the switchboard used for a country house which makes and stores its own electricity. The unbroken line from the dynamo shows the circuit of wires through which the dynamo charges the storage batteries shown in the foreground. The dotted white line shows the circuit of wires through which the current runs from the storage batteries to the house. The handles are for switching the dynamo and the storage batteries on and off.

When he repeated the experiment with two stockings of the same material, the two pairs would repel each other when electrified and held together. We now know that whenever electricity of one kind is made by any method, an exact amount of electricity of the opposite kind is always produced, and that, while similarly charged bodies repel each other, *oppositely charged bodies attract one another.*

If we rub a glass rod with a piece of silk it will become charged with positive electricity, while a piece of sealing-wax rubbed with flannel will be charged with negative electricity. Both the glass rod and the stick of sealing-wax will pick up bits of paper or pith, yet the kind of electricity is quite different in each case.

THE GOLD LEAVES IN THE BOTTLE AND WHAT THEY TELL US

The presence of either kind may be shown by a little instrument called the electroscope. Two pieces of gold leaf are attached to a brass rod or wire which may be fitted through a cork in the neck of a wide-mouthed bottle. The gold leaves are suspended inside the bottle from the bottom of the wire, and a metal disk is attached to the top of the wire outside the bottle. If we touch the disk with an electrified object, the charge will at once be shared by the disk, and will be distributed to the gold leaves. Each leaf being thus electrified with the same kind of electricity, the two will repel each other, and will stand apart and form an inverted V. In this way the most extraordinarily minute charges of electricity can be measured. If when the leaves are standing apart we touch the disk with the finger, the leaves will at once fall together again; the electric charge will run through our body to the earth and be lost.

The earth itself may be looked upon as a huge storehouse of static electricity, and, indeed, as a giant generator of current. The globe itself, and the layer of atmosphere round it, may be looked upon as the two plates of an enormous spherical condenser, the earth itself being the negatively charged plate, the atmosphere the positively charged one.

THE ELECTRICAL ILLUMINATION 200 MILES ABOVE THE EARTH

When a liquid evaporates, electricity is formed, the evaporated vapor carrying up with it a positive charge. One authority tells us that the evaporation that is continually going on all over the world bears a constant stream of positive electricity to the upper atmosphere, and that discharges occur between layers of air and cloud, giving rise under certain conditions to the wonder-glow in the northern sky which we know as the aurora borealis. These electrical effects are always greatest at the Poles, and it is in the polar regions that the aurora is most brilliant, the luminous discharges taking place sometimes at heights of more than two hundred miles above the earth.

THE LIGHTNING FLASH AND ITS FIFTY MILLION HORSE POWER

In wonderful contrast to the feeble currents of electricity caused by friction, are the intensely powerful discharges that occur during a thunderstorm. The angry clouds of the storm were the first electric dynamo, and they remain to-day vastly more powerful than any electric machine made by man. Fifty million horse power is released from the huge storage ground of the clouds, and discharged in the hundred-thousandth part of a second in the form of the blinding flash of lightning.

A Swedish scientist named Norinder has discovered that two things happen in the sky during a thunderstorm. There is what he calls a "first variation" in the conditions, which is connected with the movements of the clouds and with silent discharges of electricity—the movement of electric charges *without* a spark; this condition lasts for about ten seconds. Then there come a series of very rapid changes in the electric field, which result in the pent-up electricity's bursting the bonds which hold it—the resistance of the air between the clouds and the earth—so that it is discharged to the earth.

HOW THE LIGHTNING-CONDUCTOR GUARDS A HOUSE FROM DANGER

The charge in a Leyden jar will fly to a finger held near it. In this we see what the lightning-conductor does. It is a pointed metal rod placed on the highest part of a building, and to it leaks the electricity stored up in the thunderclouds. The result is that in the immediate surroundings enough electricity to break through to earth is seldom able to accumulate, and the safety of the building is thus secured. The conductor is connected to a metal plate buried in the earth, to which it conveys the electricity it collects.

Toward the end of the eighteenth century new discoveries were made in electricity which brought about a wonderful change and introduced an era that has entirely revolutionized the world.

Very little had been done with the static electricity produced by friction. But a new electricity was now discovered, the effects of which far transcended anything that could possibly be done with the electricity already known. Two great names, those of Volta and Galvani, of whom we read on page 1251, will be associated for all time with this discovery.

The secret of the battery had been discovered and was used as a means of producing quantities of electricity hitherto undreamed of. A number of glasses containing acidulated water were used, with a zinc and copper strip dipping into each glass, the zinc of one pair connected to the copper of the next, and so on. In this way Volta produced a "crown of cups," from which a current of what was then quite large power was obtained. Volta proved that the electricity he got from this chemical method was of exactly the same character as that which had previously been got from friction. Although he was a professor in the University of Pavia, Volta recognized that there were others who could advance the new science better than he, and for the last twenty-five years of his life he made no further attempts at electrical discoveries.

THE REMARKABLE FORCE THAT FLOWS FROM METAL TO METAL

Volta had found that when any two different metals are made to touch each other, one of them immediately assumes a different electric state from the other. If two different metals are put in a vessel filled with acid, one metal will always become electrified to a higher degree than the other. The word *potential* has been given to this state, and the secret of the battery is that if the two metals are connected by a wire, that is, by a conductor, an electric current will always flow from the metal at the higher potential to that at the lower potential.

One of the most powerful cells was invented by the famous chemist Bunsen. It consists of a cylinder of zinc standing in a jar filled with sulphuric acid. Inside the cylinder is placed a porous pot of unglazed earthenware, through which gases can pass, containing a rod of carbon and filled with nitric acid. Three or four such cells joined up so as to form a *battery* would produce enough electricity to drive a sewing-machine motor, or light a six or eight candle-power lamp. A battery of twenty Bunsen cells would light an arc-lamp. The electric battery, it will be seen, introduced the era of electric *power*, though little real use was ever made of it owing to the advent of the much more practical generator known as the dynamo.

THE FORCE THAT CAN BREAK UP COMPOUNDS INTO ELEMENTS

The real importance of the discovery of voltaic, or galvanic, electricity was that it gave a new force to man, with which he made a quick succession of other discoveries that laid the foundations of our vast knowledge of to-day. Even in the same year that Volta made his electric pile two Englishmen named Carlisle and Nicholson discovered that the new current which it produced possessed the remarkable power of releasing hydrogen and oxygen from water.

A few years later Sir Humphry Davy found that the voltaic current would split up many other substances into their elements. The electric current could do what until then fire alone had done, and far more. Science had entered a new era.

In 1820 came perhaps the greatest of all electrical discoveries in so far as it paved the way for the dynamo, the motor, the telephone, the telegraph, and all the other wonders of the electric world of to-day. Hans Christian Oersted, a Danish scientist, found that if a current from a voltaic battery was made to flow through a wire, some new and mysterious force was created around the wire which caused a compass-needle to turn around.

It had long been thought that some connection must exist between the forces of magnetism and electricity. It was left to Oersted in Copenhagen to show that the two powers were actually related, and in what way.

NOTHING IN NATURE CAN BE HAD FOR NOTHING

If a spiral cord of copper wire is wound round a pencil, and the two ends of the coil are connected to the two "poles" of a battery, the passage of the electric current through the coil makes it a magnet. The coil possesses magnetic power, and one end of it will act like the north pole of a magnet, the other end like a south pole. As long as current flows through the coil it remains an electromagnet. Place a rod of iron within the coil, and the iron becomes powerfully magnetized.

A magnet of this kind no bigger than a horseshoe, excited by the current from a couple of Bunsen cells, becomes strong enough to lift an iron scuttle filled with coal. The chemical waste going on in the battery is turned into *force*.

It is the experience all through nature that nothing can be gained without cost, and in the electric battery the same holds good—a battery will not go on forever producing current. A destructive action is, indeed, going on. The battery is a little world in itself, in which all kinds of interesting things are happening. A good example is found in the Daniell's cell, once largely used in telegraphy because of its constancy. Here we find a copper plate or cylinder standing in a solution of a blue salt called sulphate of copper, and inside the porous pot is a zinc rod standing in a solution of sulphate of zinc or weak sulphuric acid. As soon as the copper and zinc plates are joined by a wire, or connected up with an electric instrument through which a current flows, everything within the battery gets busy. A much-used modification of this cell dispenses with the porous cup and relies on the difference in density of the zinc-sulphate and copper-sulphate solutions in which the zinc and copper separately are placed.

THE MYSTERIOUS IONS WHICH WORK IN BATTERIES

In order to understand what happens we must try to imagine what the mysterious *ion* is. Chemistry tells us that all substances are made up of molecules, each molecule being the simplest arrangement of the atoms that can exist in a free state. A molecule of salt consists of one atom of sodium and one atom of chlorine. But if an electric current were passed through water in which salt has been dissolved, these molecules would be gradually split up into ions of sodium and chlorine. Each ion of sodium bears a charge of positive electricity; each ion of chlorine bears a charge of negative electricity. The sodium ions gradually travel through the water toward the negative pole, an equal number of chlorine ions travel toward the positive pole, and this process goes on steadily until all the salt is used up.

We have already seen that early in the nineteenth century it was discovered that electricity broke up water into hydrogen and oxygen in a similar way.

This marching-along of the ions takes place in every battery in one way or another. To return to the Daniell's cell, the zinc rod gradually becomes used up through ions of zinc being set free, and these travel toward the side of the porous pot. In the outer vessel the sulphate of copper is being turned into ions of copper and what we may call ions of sulphate. The copper ions travel to the copper plate, and when they meet it they instantly become transformed from invisible atoms to solid copper metal, and they actually build up and increase the weight of the copper plate. The ions of sulphate travel in the opposite direction, and make their way to the porous pot. Here they meet the zinc ions, at once join forces with them, and produce more zinc sulphate.

This busy little world of traveling ions is present in every battery. Every time you press the switch of a flash-light the little battery that supplies the lighting current begins producing ions of ammonium and chlorine, which in turn set up new chemical processes that gradually exhaust its power. This is why a battery will give only so many flashes, and has then to be renewed. New batteries are for sale in the shops.

THE ZINC AND CARBON PLATES WHICH MAKE A CURRENT

Different from the dry cell is one known as the *bichromate* pattern, which is available for experiments. In its usual form a zinc plate and two carbon plates, one on either side, are immersed in a solution of bichromate of potash acidulated with sulphuric acid. A powerful current is generated sufficiently strong to drive a toy motor or to operate a small two-volt electric lamp.

Before the dry cell the most useful and most widely employed battery was the Leclanché. Instead of the liquid solution of sal ammoniac in the glass jar it is made in the form of the so-called dry cell and is used for working electric bells and flash-lights, and is the type employed for the little high-tension batteries used in wireless receiving sets which work with a valve. The negative element is a zinc rod, or often a zinc box, forming the container of the cell; the positive element is a carbon rod inclosed in a porous pot—or a little canvas or linen bag—filled with black oxid of manganese. The liquid used is a salt known as sal ammoniac—in chemical language, chlorid of ammonium. In the dry battery, the sal ammoniac is made into a paste with sawdust, so that there is no liquid to spill, but it is not really dry, as without the presence of a liquid there would be no fluid in which the ions could travel.

While the cell is in use, hydrogen gas is often set free at the negative element in the form of tiny bubbles which cling to the metal and form a protective coating that keeps the fluid away from it. When this happens the chemical action can no longer go on, and the cell is said to be polarized. Given a short rest, the bubbles of gas disappear, and the metal is once more in contact with the fluid of the cell, which will work again. Batteries thus require frequent rests and cannot be worked continuously for too long a period.

Let us now come back for a moment to the early part of the last century, when the powers of an electric battery were first being revealed. The next illustrious name after Oersted is that of Ampère, a famous physicist of France, who made very great advances in electrical knowledge, and whose name will be used for all time as the unit of current.

THE TWO GREAT FACTS OF ELECTRICAL RESISTANCE AND ELECTRICAL HEAT

It became possible to measure the strength of an electric current by the magnetic power which it could produce, and instruments were invented by which these currents could be measured; and, just as a piece of iron placed near a magnet is itself made into a magnet, so it was found that on passing a voltaic current through a coil of wire a current could be set up in another coil of wire placed near to it.

Two great facts had also been discovered: one, that certain metals offered greater resistance to the flow of a current through them than others; the other, that the passage of an electric current through a wire made it hot. Ohm discovered that the amount of current which can flow through a conductor depends strictly on the *resistance* of the conductor, and ever afterward this property of resistance was measured in units called ohms, after his name.

THE MYSTERIOUS FORCE CONTROLLED, STARTED AND STOPPED

The effect of an electric current upon a magnet had led the way to the first means of measuring the strength of this new power that was to rule the world. Men of every nation set to work to make electricity an exact science. But for very many years its real nature was not understood, and electricity was looked upon as a mysterious fluid which flowed in, or perhaps around, the wires that conducted it.

The interest of the whole world had, at any rate, been roused, for here was a power which, produced by the action of dissimilar metals excited by a chemical liquid, could make light and heat, create magnetic power, and decompose matter and other substances into the elements of which they were made. The new power could be controlled, started and stopped; it could be led to any spot by means of conductors and be made to do work there. Greatest of all, it was shown, not only how electricity could produce magnetic power, but how magnetic power could in its turn produce electricity, and from these early observations was evolved the generator, or dynamo—the machine which to-day enables us to produce all the electricity we want from the mechanical power of the steam engine, the oil engine and the waterfall.

THE POWER THAT CAN BE SENT THOUSANDS OF MILES

Without its magnetic effects the voltaic battery would have been very limited in its uses, though it might have been developed on wonderful lines. But this remarkable connection between the two forces, separately revealed to man thousands of years ago, has brought about the harnessing of power and the means of turning power into a force that can be led, if necessary, thousands of miles to some distant spot, there to be used again.

THE DYNAMO THAT PRODUCES AN ELECTRIC CURRENT

If you could follow the little silk-covered twin wires from which an electric lamp is suspended, and could trace their path from the house into the underground tubes which run along below the street, you would finally end up at the electric generating station. The wires, together with a formidable bundle of other wires, would end in two huge cables joined to the switchboard of the *generator*. It is almost like following the pipe from an old-fashioned gas-lamp to the huge cylinder-shaped reservoirs familiar to us at the gas works. One central generating plant of sufficient size to supply the needs of a whole town distributes its power in the form of gas or electric current to the thousands of users, each of whom wants his own little quantity.

The secret of the dynamo—the electric machine which produces this current—is very simple. If a coil of wire is joined to the poles of an electric battery, the coil acts as a magnet, the current producing a magnetic field. But if such a coil is itself moved about in the field of a magnet, an electric current is set up within the coil. The dynamo is nothing more than a number of wire coils driven round between the poles of a powerful magnet. As they cut the lines of force thrown out by it an electric current is set up which is collected in a way very similar to that of storing up the current from a frictional machine.

In the early dynamos the coil in which the electric currents were set up were revolved in the field of a steel horseshoe magnet, but in order to obtain greater power an electric magnet excited by a battery was used. Later a great advance was made by actually taking some of the electricity created by the dynamo to excite its own magnet.

It must be understood that there are definite rules which magnets and coils obey when the coils are revolved in a magnetic field. According to the direction in which the coil turns, and its relation to the north and south poles of the magnet, the current will flow in a certain direction. When a coil has turned through half a circle it has become reversed, so to speak, and for the next half of the turn the current produced in it will flow the opposite way. Thus, in the simplest form of dynamo the current is changed twice in direction during every revolution; such a current is said to be *alternating*. The *armature*—the arrangement of coils used in a modern dynamo—can be so built up that the "brushes" which collect the current will produce either alternating or direct current.

The two types of current are of the greatest importance, because direct current is absolutely necessary in order to charge the huge batteries in which electricity is stored, while alternating current, on the other hand, is far more suitable for supplying power over long distances.

THE TERRIFIC PRESSURE OF ELECTRICITY AS IT COMES FROM THE DYNAMO

This brings us to the subject of the pressure of an electric current. Suppose we wanted to supply water from a tank through a pipe to some spot a long way off. We know that the tank would have to be higher up than the spot to which the water was being sent. The higher the tank was raised, the greater would be the pressure of water, the better the driving force to send it through the pipe.

We can liken the dynamo to the water tank, and the pressure of the current to the pressure of the water. Whereas water pressure is measured by saying there is so much *head* of water, electricity is measured by saying that its pressure is so many *volts*. In the early days of electric lighting 116 volts was quite a usual pressure, but it was soon found that as electricity was sent over greater distances this pressure was not enough, and to-day it may be 200, 220, 400, or more, for power supplies.

When the problem arose of sending electricity over really great distances—when electric power was generated by using the driving force of waterfalls and sending it to spots perhaps a hundred miles away—much higher pressures had to be used, and currents at 100,000 volts' pressure are in use to-day.

The great pioneer Ohm discovered a law which is perhaps the most useful of all electrical laws. It is that when a current flows through any completed course, which we shall in future call a circuit, the *amount of current is equal to the voltage divided by the resistance.*

WATERFALLS AND RIVERS THAT DRIVE LARGE ELECTRIC GENERATORS

Three great scientists gave their names to the units in which these electrical quantities are given: Ampère, Volta and Ohm. Current is measured in *amperes,* pressure in *volts,* and resistance in *ohms.* If a current of one-volt pressure flows through a circuit, the resistance of which is only one ohm, the current strength will be one ampere.

We can see, then, that if a current is sent through a wire of great length, having therefore great resistance, it will be greatly diminished in strength. But it is diminished less and less as the voltage is made bigger, so that for very long distances the voltage is really enormous.

Tens of millions of horse power are generated to-day by harnessing the natural power of waterfalls and swiftly running rivers to drive water turbines. Modern water-wheels are as far ahead of the old water-wheels as the huge turbines of an Atlantic liner are ahead of the old-fashioned paddle-wheel in steamboats. These power turbines, driven by water which has for centuries gone to waste, are made to drive large electric generators. But waterfalls and water power are very rarely situated near a big manufacturing town or a big city which requires current for its lighting and its street railways.

HOW POWER IS CARRIED ALONG WIRES A HUNDRED MILES OR MORE LONG

The electricity has thus to be *transmitted* from the scene of the waterfall to towns and cities miles away—sent through wires perhaps a hundred miles or more long. It is in such cases as these that high voltages are used, and the conducting wires are suspended from poles high up in the air, as to touch them would mean instant death. The poles themselves have to be made of steel in many countries to protect them from the attack of insects. These wires must be kept apart, too, as one wire, of course, conveys the positive electricity, the other the negative, and the two opposite kinds of electricity are always trying to come together. In damp weather, when the air conducts well, a bright glow can often be seen at night around the wires; it is the wonderful force which strives to jump from one wire to the other; indeed loss of electricity is involved through this effort.

THE SAFETY FUSE-BOX AND WHAT IT DOES

In case any positive wire should accidently touch a negative wire, and so cause a short circuit, automatic cut-outs, or fuses, are used on a large scale. A home lighted with electricity is sure to have one or more fuse-boxes somewhere, containing a number of fuse-wires which protect the electric circuits from danger.

We have seen that when electricity flows through a wire it heats it. If a big current flows through a thin wire it will heat it to such an extent that the wire will melt. This is exactly how a fuse is made. Every here and there in lighting or motor circuits—in fact, wherever electricity is used—the electrician puts a fuse-wire contained in a little porcelain box. This wire is often made of tin—which melts at a very low temperature—sometimes of other metals. In each case, if through any accident too much current flows through the circuit, the fuse-wire will melt. An air-gap will be instantly made in the circuit, so that the current can no longer flow.

Much more elaborate fuses, or cut-outs, are used in circuits where really high power is being used, but the principle is always the same; as soon as an excessive current flows, something gives way, and an air-gap is made in the circuit, offering a tremendously high resistance.

The wires leading from the generating station, known as the electric mains, are heavy copper cables carefully insulated and sheathed in lead and laid in wood, earthenware or iron troughs under the ground. These tunnels are usually placed about fifteen inches below the footway, or twice that depth below roadways.

In each office, factory or house the current must first pass through a meter, or measuring instrument, which keeps a record of all the current used. Coal-gas is measured in different ways; electricity in kilowatt hours, which means the use of a thousand watts for one hour. A watt means the flow of a current of one ampere at a pressure of one volt.

The electricity meter is one of the most delicate, intricate and wonderful instruments in existence to-day. Several different kinds of meter are in use, some depending on the amount of chemical action caused by the current, others depending on a motor made to turn and count by the current passing through it, and others, again, in which a clock drives a counting machine as long as a current is flowing through the meter.

THE STORAGE BATTERY PROVIDES A RESERVE OF CURRENT

As long as a dynamo is driven by a steam engine, or some other kind of power, it continues to produce electricity. As soon as it stops, the electric current it has been generating stops too. It can thus be understood how necessary it is to be able to "put by" some electricity for an emergency; how useful it is to be able to store up the output of current, so that it can be rationed out.

The *storage battery,* or *accumulator,* does more than this. A dynamo can be run all night when the world is at rest and no electricity is wanted, and its output can be stored in a storage battery. The next day busy cars or electric trains, and the hundreds of electric motors in use create a very big demand for current. Then the reserve energy in the storage battery can be added to the output of the dynamo. An extra amount of electricity can be supplied at any moment.

There are many instances where a store of electricity is absolutely necessary. The case of the electric car is one. An electric delivery van, or carriage, can usually run for a distance of fifty or sixty miles. Its supply of current is self-contained or stored up in a small battery which can be fixed in a box beneath the body.

Everyone who uses a tube receiver in a wireless receiving apparatus has a storage battery to supply the current to light the valve filament. Storage batteries are used wherever electric power in a portable form is required.

One of the first instruments for storing electricity was invented by Benjamin Franklin, of whom we read on page 1248, and was known as "Franklin's pane." It was a pane of glass with a large sheet of tinfoil pasted on each side. By connecting it with a frictional machine it was possible to store a certain amount of static electricity. But static electricity, as we have seen, has entirely given place to the more powerful currents of the galvanic or voltaic battery, or the dynamo. Since such currents produce very pronounced chemical changes, it followed that the storage battery was devised.

A battery which could be charged with electricity and could be made to give the electricity back again was discovered in 1860 by Gaston Planté. It consisted of two sheets of lead rolled up together, with strips of some insulating material such as flannel between them, to prevent the two plates touching each other. This roll of the separated lead plates was placed in a mixture of sulphuric acid and water. Then the current from a dynamo was connected with the two plates until bubbles of gas were given off at their surface. When the cell was disconnected and the plates connected with some apparatus requiring a current, such as a lamp, it was found that the cell gave out the electric energy that had been produced and stored within it.

An electric storage cell may be looked upon as something capable of receiving, retaining and giving up again the energy put into it from a dynamo or from an ordinary electric battery. Such a cell must not be thought to store electricity *as electricity.* The electric force put into the cell is changed into chemical energy, and this chemical power is again turned into electricity when the cell is discharged.

The modern storage battery, used on an immense scale to-day, is amazingly simple in construction. The positive and negative elements, or plates, are made in the form of flat grids, lead perforated or honeycombed, and filled with a paste of oxid of lead.

THE PRESSURE IN A CELL WHICH MAY EQUAL 200 TONS

In the type of plate invented by Faure red lead oxid is used in making the positive plates. On the passage of an electric current it becomes a final hard paste of lead sulphate and lead peroxid. The negative plate, on the other hand, is filled with litharge. This is reduced to a spongy black form of lead when the cell is charged. These pastes are forced into the lead grids under great pressure, sometimes equal to as much as 200 tons.

The amount of electricity that can be stored in a storage battery depends very largely on the area of the plates. In order to keep each cell of a convenient size the larger ones are made up of a number of positive and negative plates placed alternately in big glass vessels. All the negative and all the positive plates are connected so that in each cell there are just the two terminals, positive and negative.

The average voltage of a cell is only two volts. Where a storage battery is to be used for electric lighting, fifty or a hundred or more cells must be used, according to the voltage of the lamps. By connecting the positive of one cell to the negative of the next, and so on—which is called joining the cells *in series*—the voltage is multiplied by the number of cells. Thus 110 cells would give 220 volts, and so on.

The amount of electric energy that may be produced in a battery depends on the area of the surface of the positive plates in any one cell. If the battery could light a hundred lamps each requiring an ampere of current for ten hours, the "capacity" of the battery would be 100 multiplied by 10, or 1,000 ampere-hours.

THE STORAGE OF ELECTRIC POWER LIKE THE WINDING OF A SPRING

The little four-volt batteries made for pocket flash-lights are often made with a capacity of 4 ampere-hours, while six-, eight- or twelve-volt batteries for lighting motor cars are usually of from 20 to 60 ampere-hours' capacity. Thus the *voltage* of a storage battery depends on the number of cells that are connected in series, and the *capacity* depends upon the number of square inches of surface of the positive plates in one of the cells.

What is the secret of these simple grids that lie in a vessel of weak sulphuric acid? What happens when energy is stored up in the plates, or robbed from them? There has been no little discussion among electricians as to what really does happen. There is no doubt that the real elements that play their parts are very finely divided lead metal in the negative plate, and peroxid of lead in the positive plate. When energy is being stored up in the cell, metallic lead is deposited on the negative plate, and sulphuric acid is generated. Oxygen is set free at the positive plate, forming oxid of lead.

These chemical changes represent the storage of electric power. It is like winding the spring of a clock, which tries hard to unwind, and in so doing drives the clockwork mechanism until the spring is unwound. In a similar way the lead deposited on the negative plate tries to combine with the sulphuric acid to form sulphate of lead. In so doing it releases hydrogen gas, which travels in the form of *ions* to the positive plate, combines with oxygen, and causes a compound of lead to be formed. This at once unites with the sulphuric acid to form sulphate of lead. These changes can take place over and over again, so that the battery can be charged and discharged thousands of times, and used as a temporary accommodation for electric power.

WHY THE STORAGE BATTERY MUST BE CHARGED FROM TIME TO TIME

The storage battery thus serves not only as a store of power, but as a stand-by against breakdown on the part of a generating station. It is also an auxiliary force which can be added to that of the power station when there is an extra demand on the supply.

So many small storage batteries are used to-day for electric lighting, motor-car ignition, and wireless receiving sets that something may well be said about their general behavior and upkeep.

There are two serious faults in the lead storage battery. One is the weight; the other the fact that a charged battery when not in use will gradually lose its electricity. But, as we shall see, both these faults have been in some measure overcome in recent years.

Storage batteries accordingly must be charged with current from time to time, whether they are used or not. They are quickly ruined if they are allowed to stand "empty" for any length of time.

THE ACID AND PURE WATER IN THE BATTERY CELLS

When freshly charged, each cell will give rather more than two and a half volts. If the battery be made to light a lamp the voltage will soon drop to two volts and will then remain fairly constant until about three-fourths discharged. Then it will drop in voltage by a quarter-volt. This would mean a serious drop in a large battery of fifty cells, for the voltage would drop from 125 volts to less than 90, and the electric lamps supplied by the battery would be less bright. Hence the electrical engineer must be provided with a battery so big that it will never be too much "run down," or else he must have extra cells that can be added to the battery to increase its voltage when low.

Small storage batteries often give trouble because the acid in them evaporates. The lead grids must be always just covered with acid. To make up for evaporation a little distilled, or pure, water must be added from time to time.

The great weight of a lead battery is of little moment when used at generating stations, for there its power can be added to that of the dynamos at periods of "heavy load." But we shall look forward to something of a revolution in our means of light traffic when some form of really light and portable battery is discovered. The little storage battery packed away in a motor car is sufficient to start up the engine, and is used in all self-starter cars. Suppose now that we could store sufficient energy within the battery to drive the car, too, perhaps for two or three hundred miles. This is the day that is looked forward to by the hundreds of inventors who, week by week, and year by year, apply themselves to this problem.

THE EDISON STORAGE BATTERY THAT CAN DRIVE A CAR FOR FIFTY MILES

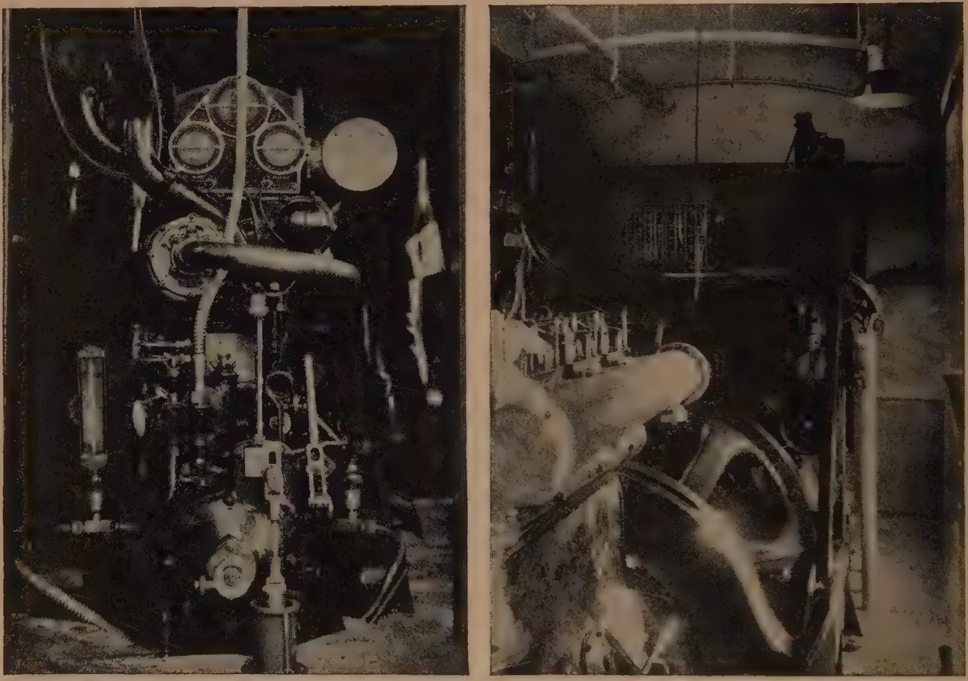
The solution, however, has been found already to some extent. Edison has invented a storage battery in which nickel takes the place of lead. Nickel is hardly one-fourth of the weight of lead. Year after year this great American inventor toiled at his experiments, and ultimately he was rewarded with success. The plates of his new battery were composed of nickel grids fitted with a new chemical compound. Caustic soda was used instead of the acid employed in all lead batteries.

Many of these Edison batteries are used to-day, but the standard types of lead battery are much more common. Edison was able to equip a comfortable little brougham type of car with a light battery containing sufficient electricity to drive it for fifty or sixty miles. This was a great advance on anything that had been done previously in the way of an electric vehicle.

THE POWER WHICH CAN EXIST IN A THOUSAND FORMS

A fascinating feature of the storage-battery plate, or grid, is that when it is once charged with electricity in its liquid cells, it can be actually removed, dried, and sent away to some distant place, when, as soon as it is set up again in a vessel filled with acid, it will give out its pent-up energy.

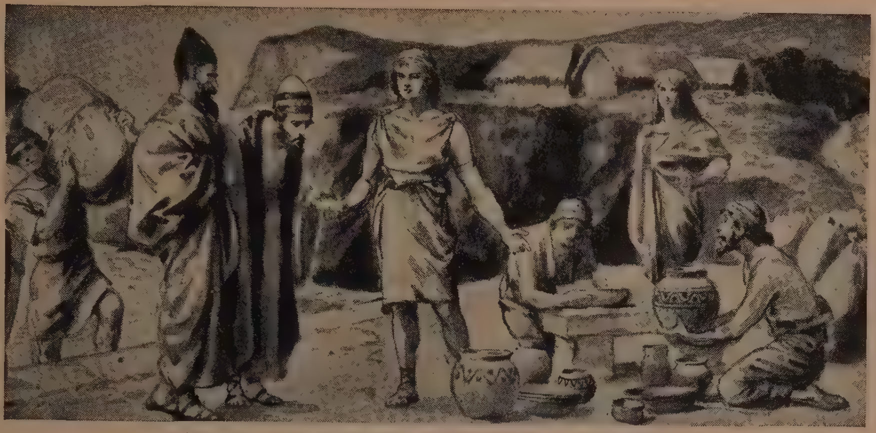
As surely as power in the form of oil or gasoline can be sent from the bowels of the earth to some other continent across the sea in a tank steamship, so electric power can be sent from one spot to another in the form of potential energy stored up in the chemical composition of the storage-battery grid. It is another example of the remarkable nature of power, which can exist in a thousand different forms.



Photo, courtesy Canadian National Railways.

Here we have two pictures of the new oil-electric engine which drove a Canadian National Railway car 2,937 miles across Canada in sixty-seven hours. The engine operates an electric generator and this provides the actual energy to move the car. The engine itself is started by a small electric motor which gets its power from storage batteries. These batteries are recharged from the generator when the car is in motion. The car is started by the battery driving the generator as a motor. In case of an engine failure, in an emergency the car can be run at a slow speed from the battery.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 5797.



The Phœnicians of old bartering clothes and pottery.

MONEY AND WHY WE USE IT

HERE is a quarter. It is a piece of silver stamped on both sides. Think what we can do with this quarter. We can in any part of the country transform it into a great variety of things. It will buy a small box of candy, or bananas from Central America, or a ride on the railway, or a copy of a magazine, or bread or rolls, or a pocket handkerchief, or a small doll, or a screwdriver, or stamps with which we can send our letters to the other side of the world, or many other things. When we spend our quarter we command the whole world—to the extent of one quarter's worth. How wonderful was the invention of Money, and how far-reaching its influence on the everyday life of the world!

So wonderful it is that its use has been one of the most wonderful instruments in building up civilized life. It gives us the power readily to exchange our own work, or the products of our own work, for the work of others. It enables us to obtain things made in foreign countries we have never seen.

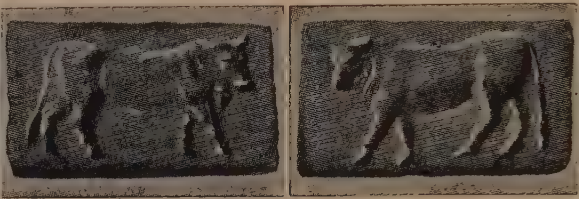
Let us try to imagine what life would be without money. Suppose we made shoes for a living. If money had not been invented, we should have to find people willing to change other things for the shoes we made. We should have to go into the market and cry: "Who will offer me food, hats or other useful things in exchange for my shoes?" How awkward that would be! We should have to find a hat-maker who thought one of his hats was as good value as a pair of our shoes. We should have to bargain another pair of shoes with someone willing to give us a supply of bread. It would be a very clumsy and difficult process, so clumsy and difficult that there would be very little trade, and we should all be very poor.

Time was, before the invention of money, thousands of years ago, when simple barter was the only form of trade. Indeed, there are still parts of the world inhabited by uncivilized tribes living very much as our forefathers lived long ago in Europe, where trade is done in this way, and where white traders take with them guns, or knives, or ornaments to make exchange with. So traders obtain valuable furs from people like the Eskimos in the Far North.

Barter is very difficult, because in exchanging goods for goods we have to find the person who happens to want just the thing we wish to exchange.

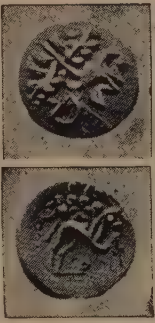
Another difficulty is that many things cannot be cut up into readily exchangeable portions. For example, suppose we have a horse, or a big table, which we desire to barter. We cannot cut up the horse or the table, and therefore to exchange them we have to find somebody who can offer a quantity of things equal in value to the whole of our horse or the whole of our table. This is plainly an event which may not happen every day.

Tigranes, king of Armenia.

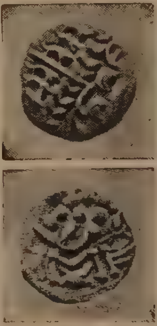

Early Roman bar money of the fourth century B.C.

Demetrius Poliorcetes, king of Macedonia.

Gold coin of Philip of Macedon.


An early British coin.

Coin of Alexander the Great.


An early British coin.

Coin of the fifth century B.C.

An early British coin.

A coin of the sixth century B.C.

SOME OF THE EARLIEST KNOWN COINS IN EXISTENCE

So in many different countries the desire to exchange led long ago to the invention of money. The beginning of money was simply that people agreed with each other to recognize some particular article as a general standard of value. Many different things came to be used as money from time to time. A man's wealth came to be reckoned, as we find recorded in the Old Testament, by the size of his flocks and herds. So among the earliest standards of value we find cattle, and cattle were actually used as money. Grain, however, was a much better form of money because it could easily be divided into small quantities; an animal could not be. The American Indians used shells for money, and, later, furs. The Virginia colonists used tobacco. Many other things came to be used as money in the early days, as, for example, bars of iron.

As civilization advanced and metals came into use, they became more and more used as money. Especially was this true of the rare metals. Gold and silver not only were rare, but were desired for their beauty. Everyone was therefore willing to accept them in exchange for any other goods they had. Moreover, they were not only rare, but almost indestructible, and easily divided into pieces of any size, so that a little piece could be exchanged for some food, a larger piece for a horse, or a still larger piece for a house or land.

Nothing will serve as money unless

there is confidence in its use. People will not give goods in exchange for money unless they are sure that when they get the money they will be able to exchange it for other goods. Confidence in gold and silver money arose from long experience that these two metals remained rare and valuable, and so they became accepted everywhere as good money. You could change an ox for gold in the confidence that either at once, or later, the gold could be exchanged for other things.

WHY MONEY IS SUCH A GOOD THING TO USE FOR EXCHANGE

The qualities of good money may be thus summed up: It must be generally recognized as a standard of value. It must be confidently accepted as a medium of exchange. It must be readily divisible into small parts, so that small things as well as big things may be exchanged by means of it.

When we change goods for money we are said to Sell. When we change money for goods we are said to Buy. This buying and selling by means of money enable us to speak of things as being *worth so much money*. So money conveniently measures value by a common standard. This measurement of value by money we call Price. The price of an article is its value expressed in money.

It is just because money so conveniently measures the value of things that it is so excellent a medium of exchange. When we know that our money will buy more of this or less of that, we are greatly assisted by prices in forming a judgment as to what to buy and what to sell.

Gold came to be adopted by nearly all civilized countries as a standard money. It is not only rare, but stable in value. It is almost indestructible, and loses none of its value by being divided into small coins. It is everywhere desirable and confidently accepted. Finally, as a small piece of it is of high value, a considerable amount of money in gold can be easily carried on the person.

THE COINS OF SMALL VALUE WHICH ARE MERELY USED AS TOKENS

The standard coin of both the United States and Canada is the gold dollar containing 23.22 grains of pure gold. The United States coins a silver dollar also, but though this coin is on the list of Canadian coins, none has ever been issued. The other coins we use—silver, nickel and bronze or copper—are merely tokens and are coined for convenience in small transactions. We could not use gold quarters or gold cents because they would be so absurdly small. Our smaller coinage can be legally used only in making small payments; anybody can refuse to accept payment for more than a quarter in cents.

Different countries use different moneys. Here is a table which shows the value of the coins in certain countries in 1914:

Standard Money of Certain Countries

Country	*Coin*	*Value in 1914*
England	Pound	$4.8665
France	Franc	19.3 cents
Germany	Mark	nearly 24 cents
Russia	Ruble	just over 51 cents
Italy	Lira	19.3 cents
Austria	Krone	just over 20 cents
Spain	Peseta	19.3 cents
Belgium	Franc	19.3 cents
Holland	Guilder	just over 40 cents
Sweden	Krona	26.8 cents
Turkey	Piastre	4.4 cents
Japan	Yen	just under 50 cents
Argentina	Peso	96.48 cents

WHY ARE SOME BANK-NOTES AS GOOD AS GOLD?

Great changes, however, were made by the World War. Governments, faced with the terribly high expenses of carrying on the campaign and dealing with the difficulties which arose after the conclusion of the war, resorted to the plan of printing large quantities of Paper Money in order to pay their way. Now, as long as a Government keeps gold, or the ability to buy gold, at the back of the paper money which it issues, the paper money is as good as gold, because the holder is able at any time to change it into gold. That is the case with our paper money. It is a piece of paper money which is really as good as gold, because the Government or the bank always holds itself willing to change it into gold. Paper money like that is good money, because it is worth its face value.

It is very different, however, with the paper money which was printed in France, Germany, Italy, Russia, Austria, and many other countries, after the war began. Such paper money cannot be changed into gold, and as more and more of it has been printed, it has fallen more and more in value, and people have less and less confidence in it. As each fresh batch is printed the prices of goods rise, which really means that the money is worth less.

The money of many European and South American states is worth much less in gold than its full value.

WHY A NATION SHOULD TRY TO KEEP ITS MONEY GOOD

So we see that money may be good or bad, and it is very important to a nation to keep its money good. Governments which need to spend a great deal are sometimes tempted, as in Europe through the World War, to issue huge quantities of bad money. When this is done people lose faith in it, because, as we have seen, there cannot be confidence in money unless it is generally recognized as a standard of value and confidently accepted as a medium of exchange.

During the war most governments engaged issued paper money which they could not redeem at the time, but some of them issued as little as seemed possible. After the war some of these governments, Great Britain, for example, retired some of these notes, built up stocks of gold and "resumed specie payments." This means that they are ready to give gold for notes. Other countries have not been able to do this. This is the reason why a Bank of England note is now as good as gold, while a French or Belgian note is not.

Let us see the terms which are used to describe good and bad paper money. Good paper money is in the form of Convertible Notes, so called because, although consisting of printed bits of paper, each piece is as good as gold and gold can be obtained for it.

Bad paper money, like the German mark or the Russian ruble in 1924, is called Inconvertible Notes because gold cannot be obtained for them, and because their value consists merely of what they will buy in the market, their buying power falling as the number of such notes increases. In Russia the Bolshevist Government issued so much paper money that it was worth less than the blank paper.

BUYING AND SELLING THINGS WITHOUT THE USE OF MONEY

Now we come to an extraordinary thing. When a nation has good money, and when, as a consequence, there is perfect confidence in the national money, *we are able to do most of our business without using money at all.* This, fortunately, is the privilege we enjoy in our country.

It is only in small transactions, such as paying wages, or buying retail in shops, that coin is actually used in our country. In all big transactions connected with wholesale buying and selling, and finance, and in a great deal of retail buying, we do not use coins or bank-notes, but just *pieces of paper on which we have written promises to pay.*

Such a paper promise to pay is called a Check, and is as good as money itself if it complies with the following conditions:

1. The check orders a certain bank to pay money, and the bank must be known to be a sound and good one which will always meet its liabilities.
2. The money must be good sound money, as fortunately we have in our country, so that the amount mentioned on the check is a definite known value.
3. The firm or individual drawing the check must be known to be honest people who would not make a written promise to pay unless they had the money to meet it.

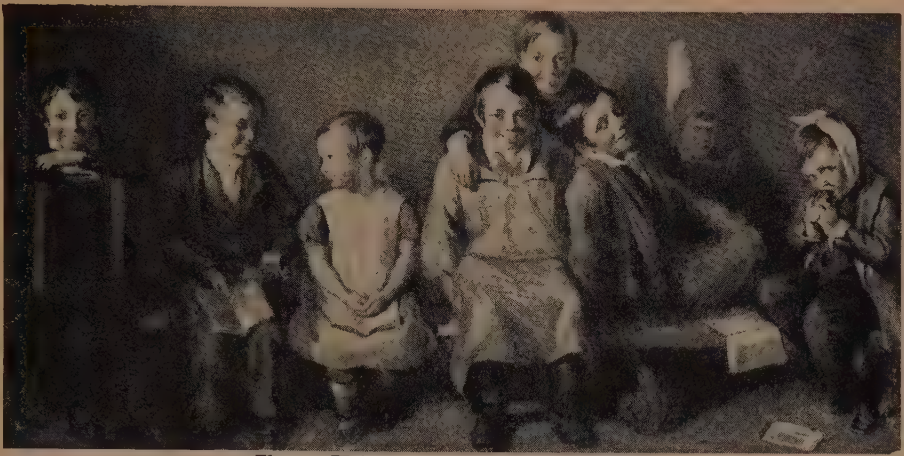
Given these conditions, the check when signed becomes a magic piece of paper as good as gold.

HOW THE CHECK SYSTEM HELPS THE BUSINESS OF THE WORLD

When civilization reaches the point at which men are able so to believe in each other's honesty that they can accept from each other, without doubt or suspicion, promises to pay on pieces of paper, and when the money of a country is good, an enormous amount of business can be done with the use of very little coin.

Every day tens of thousands of business firms are sending checks, or paper promises to pay, to each other. These checks are paid into the banks, and the banks on which the checks are drawn have a central office, called a Clearing House, which enables them to set off against each other the multitude of checks drawn on them. Thus, between one bank and another, comparatively little money has to pass, and the check system resolves itself into one in which the actual use of money is almost entirely avoided. But let us observe that it is avoided only because of the very nature and conditions of its existence. If we had bad paper money, we could not use checks, but should have to keep in our houses or offices, and carry about with us, great piles of paper notes whose value would change from day to day. Unfortunately, the existence of bad money in a country is an evil, not only for the nation which issues it, but for the world as a whole.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 5933.



Thomas Webster's picture of an old school.

A SCENE FROM NICHOLAS NICKLEBY

By Charles Dickens

A RIDE of two hundred and odd miles in severe weather, is one of the best softeners of a hard bed that ingenuity can devise. Perhaps it is even a sweetener of dreams, for those which hovered over the rough couch of Nicholas and whispered their airy nothings in his ear, were of an agreeable and happy kind. He was making his fortune very fast indeed, when the faint glimmer of an expiring candle shone before his eyes, and a voice he had no difficulty in recognising as part and parcel of Mr. Squeers, admonished him that it was time to rise.

"Past seven, Nickleby," said Mr. Squeers.

"Has morning come already?" asked Nicholas, sitting up in bed.

"Ah! that has it," replied Squeers, "and ready iced too. Now Nickleby, come; tumble up, will you?"

Nicholas needed no further admonition, but "tumbled up" at once, and proceeded to dress himself by the light of the taper, which Mr. Squeers carried in his hand.

"Here's a pretty go," said that gentleman; "the pump's froze."

"Indeed!" said Nicholas, not much interested in the intelligence.

"Yes," replied Squeers. "You can't wash yourself this morning."

"Not wash myself!" exclaimed Nicholas.

"No, not a bit of it," rejoined Squeers tartly. "So you must be content with giving yourself a dry polish till we break the ice in the well, and can get a bucketful out for the boys. Don't stand staring at me, but do look sharp, will you?"

Offering no further observation, Nicholas huddled on his clothes. Squeers, meanwhile, opened the shutters and blew the candle out; when the voice of his amiable consort was heard in the passage, demanding admittance.

"Come in, my love," said Squeers.

Mrs. Squeers came in, still habited in the primitive night-jacket which had displayed the symmetry of her figure on the previous night, and further ornamented with a beaver bonnet of some antiquity, which she wore, with much ease and lightness, on the top of the nightcap before mentioned.

"Drat the things," said the lady, opening the cupboard; "I can't find the school spoon anywhere."

"Never mind it, my dear," observed Squeers in a soothing manner; "it's of no consequence."

"No consequence, why how you

talk!" retorted Mrs. Squeers sharply; "isn't it brimstone morning?"

"I forgot, my dear," rejoined Squeers; "yes, it certainly is. We purify the boys' bloods now and then, Nickleby."

"Purify fiddlesticks' ends," said his lady. "Don't think, young man, that we go to the expense of flower of brimstone and molasses, just to purify them; because if you think we carry on the business in that way, you'll find yourself mistaken, and so I tell you plainly."

"My dear," said Squeers frowning. "Hem!"

"Oh! nonsense," rejoined Mrs. Squeers. "If the young man comes to be a teacher here, let him understand, at once, that we don't want any foolery about the boys. They have the brimstone and treacle, partly because if they hadn't something or other in the way of medicine they'd be always ailing and giving a world of trouble, and partly because it spoils their appetites and comes cheaper than breakfast and dinner. So, it does them good and us good at the same time, and that's fair enough, I'm sure."

Having given this explanation, Mrs. Squeers put her hand into the closet and instituted a stricter search after the spoon, in which Mr. Squeers assisted. A few words passed between them while they were thus engaged, but as their voices were partially stifled by the cupboard, all that Nicholas could distinguish was, that Mr. Squeers said what Mrs. Squeers had said, was injudicious, and Mrs. Squeers said what Mr. Squeers said, was "stuff."

A vast deal of searching and rummaging ensued, and it proving fruitless, Smike was called in, and pushed by Mrs. Squeers, and boxed by Mr. Squeers; which course of treatment brightening his intellects, enabled him to suggest that possibly Mrs. Squeers might have the spoon in her pocket, as indeed turned out to be the case. As Mrs. Squeers had previously protested, however, that she was quite certain she had not got it, Smike received another box on the ear for presuming to contradict his mistress, together with a promise of a sound thrashing if he were not more respectful in future; so that he took nothing very advantageous by his motion.

"A most invaluable woman, that, Nickleby," said Squeers when his consort had hurried away, pushing the drudge before her.

"Indeed, sir!" observed Nicholas.

"I don't know her equal," said Squeers; "I do not know her equal. That woman, Nickleby, is always the same—always the same bustling, lively, active, saving creetur that you see her now."

Nicholas sighed involuntarily at the thought of the agreeable domestic prospect thus opened to him; but Squeers was, fortunately, too much occupied with his own reflections to perceive it.

"It's my way to say, when I am up in London," continued Squeers, "that to them boys she is a mother. But she is more than a mother to them; ten times more. She does things for them boys, Nickleby, that I don't believe half the mothers going would do for their own sons."

"I should think they would not, sir," answered Nicholas.

Now, the fact was, that both Mr. and Mrs. Squeers viewed the boys in the light of their proper and natural enemies; or, in other words, they held and considered that their business and profession was to get as much for every boy as could by possibility be screwed out of him. On this point they were both agreed, and behaved in unison accordingly. The only difference between them was, that Mrs. Squeers waged war against the enemy openly and fearlessly, and that Squeers covered his rascality, even at home, with a spice of his habitual deceit; as if he really had a notion of some day or other being able to take himself in, and persuade his own mind that he was a very good fellow.

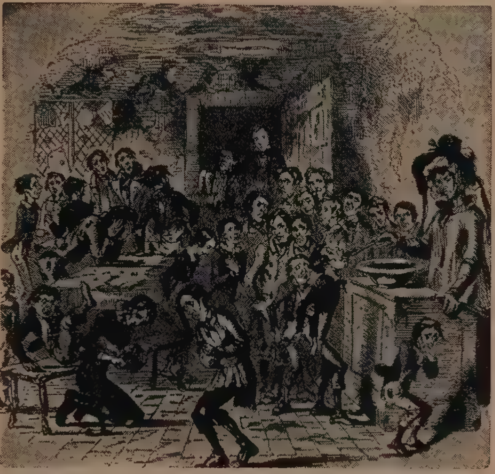
"But come," said Squeers, interrupting the progress of some thoughts to this effect in the mind of his usher, "let's go to the school-room; and lend me a hand with my school coat, will you?"

Nicholas assisted his master to put on an old fustian shooting-jacket, which he took down from a peg in the passage; and Squeers, arming himself with his cane, led the way across a yard, to a door in the rear of the house.

"There," said the schoolmaster as they stepped in together; "this is our shop, Nickleby!"

It was such a crowded scene, and there were so many objects to attract attention, that, at first, Nicholas stared about him, really without seeing anything at all. By degrees, however, the place resolved itself into a bare and dirty room, with a couple of windows, whereof a tenth part might be of glass, the remainder being stopped up with old copybooks and paper. There were a couple of long old rickety desks, cut and notched, and inked, and damaged, in every possible way; two or three forms; a detached desk for Squeers; and another for his assistant. The ceiling was supported, like that of a barn, by cross beams and rafters; and the walls were so stained and discolored that it was impossible to tell whether they had ever been touched with paint or whitewash.

But the pupils—the young noblemen! How the last faint traces of hope, the remotest glimmering of any good to be derived from his efforts in this den, faded from the mind of Nicholas as he looked in dismay around! Pale and haggard faces, lank and bony figures, children with the countenances of old men, deformities with irons upon their limbs, boys of stunted growth, and others whose long meagre legs would hardly bear their stooping bodies, all crowded on the view together; there were the bleared eye, the hare-lip, the crooked foot, and every ugliness or distortion that told of unnatural aversion conceived by parents for their offspring, or of young lives which, from the earliest dawn of infancy, had been one horrible endurance of cruelty and neglect. There were little faces which should have been handsome, darkened with the scowl of sullen, dogged suffering; there was childhood with the light of its eye quenched, its beauty gone, and its helplessness alone remaining; there were vicious-faced boys, brooding, with leaden eyes, like malefactors in a jail; and there were young creatures on whom the sins of their frail parents had descended, weeping even for the mercenary nurses they had known, and lonesome even in their loneliness. With every kindly sympathy and affection blasted in its birth, with every young and healthy feeling flogged and starved down, with every revengeful passion that can fester in swollen hearts eating its evil way to their core in silence, what an incipient Hell was breeding here!



Brimstone-and-treacle morning at Dotheboys Hall.

And yet this scene, painful as it was, had its grotesque features, which, in a less interested observer than Nicholas, might have provoked a smile. Mrs. Squeers stood at one of the desks, presiding over an immense basin of brimstone and treacle, of which delicious compound she administered a large instalment to each boy in succession: using for the purpose a common wooden spoon, which might have been originally manufactured for some gigantic top, and which widened every young gentleman's mouth considerably: they being all obliged, under heavy corporal penalties, to take in the whole of the bowl at a gasp. In another corner, huddled together for companionship, were the little boys who had arrived on the preceding night, three of them in very large leather breeches, and two in old trousers, a something tighter fit than drawers are usually worn; at no great distance from these was seated the juvenile son and heir of Mr. Squeers—a striking likeness of his father—kicking, with great vigor, under the hands of Smike, who was fitting upon him a pair of new boots that bore a most suspicious resemblance to those which the least of the little boys had worn on the journey down—as the little boy himself seemed to think, for he was regarding the appropriation with a look of most rueful amazement. Besides these, there was a long row of boys waiting, with countenances of no pleasant anticipation, to be treacled; and another file, who had just escaped from the infliction, making wry mouths indicative of anything but satisfaction. The whole were attired in such motley, ill-sorted garments, as would have been irresistibly ridiculous, but for the foul appearance of dirt, disorder, and disease, with which they were associated.

"Now," said Squeers, giving the desk a great rap with his cane, which made half the little boys nearly jump out of their boots, "is that physicking over?"

"Just over," said Mrs. Squeers, choking the last boy in her hurry, and tapping the crown of his head with the wooden spoon to restore him. "Here, you Smike; take away now. Look sharp!"

Smike shuffled out with the basin, and Mrs. Squeers having called up a little boy with a curly head and wiped her hands upon it, hurried out after him into a species of wash-house, where there was a small fire and a large kettle, together with a number of little wooden bowls which were arranged upon a board.

Into these bowls, Mrs. Squeers, assisted by the hungry servant, poured a brown composition which looked like diluted pincushions without the covers, and was called porridge. A minute wedge of brown bread was inserted in each bowl, and when they had eaten their porridge by means of the bread, the boys ate the bread itself, and had finished their breakfast; whereupon Mr. Squeers said, in a solemn voice, "For what we have received, may the Lord make us truly thankful!"—and went away to his own.

Nicholas distended his stomach with a bowl of porridge, for much the same reason which induces some savages to swallow earth—lest they should be inconveniently hungry when there is nothing to eat. Having further disposed of a slice of bread and butter, allotted to him in virtue of his office, he sat himself down to wait for school-time.

He could not but observe how silent and sad the boys all seemed to be. There was none of the noise and clamor of a school-room; none of its boisterous play, or hearty mirth. The children sat crouching and shivering together, and seemed to lack the spirit to move about. The only pupil who evinced the slightest tendency towards locomotion or playfulness was Master Squeers, and as his chief amusement was to tread upon the other boys' toes in his new boots, his flow of spirits was rather disagreeable than otherwise.

After some half-hour's delay, Mr. Squeers reappeared, and the boys took their places and their books, of which latter commodity the average might be about one to eight learners. A few minutes having elapsed, during which Mr. Squeers looked very profound, as if he had a perfect apprehension of what was inside all the books, and could say every word of their contents by heart if he only chose to take the trouble, that gentleman called up the first class.

Obedient to this summons there ranged themselves in front of the schoolmaster's desk, half-a-dozen scarecrows, out at knees and elbows, one of whom placed a torn and filthy book beneath his learned eye.

"This is the first class in English spelling and philosophy, Nickleby," said Squeers, beckoning Nicholas to stand beside him. "We'll get up a Latin one, and hand that over to you. Now, then, where's the first boy?"

"Please, sir, he's cleaning the back parlor window," said the temporary head of the philosophical class.

"So he is, to be sure," rejoined Squeers. "We go upon the practical mode of teaching, Nickleby; the regular education system. C-l-e-a-n, clean, verb active, to make bright, to scour. W-i-n, win, d-e-r, der, winder, a casement. When the boy knows this out of the book, he goes and does it. It's just the same principle as the use of the globes. Where's the second boy?"

"Please, sir, he's weeding the garden," replied a small voice.

"To be sure," said Squeers, by no means disconcerted. "So he is. B-o-t, bot, t-i-n, bottin, n-e-y, ney, bottinney, noun substantive, a knowledge of plants. When he has learned that bottinney means a knowledge of plants, he goes and knows 'em. That's our system, Nickleby; what do you think of it?"

"It's a very useful one, at any rate," answered Nicholas.

"I believe you," rejoined Squeers, not remarking the emphasis of his usher. "Third boy, what's a horse?"

"A beast, sir," replied the boy.

"So it is," said Squeers. "Ain't it, Nickleby?"

"I believe there is no doubt of that, sir," answered Nicholas.

"Of course there isn't," said Squeers. "A horse is a quadruped, and quadruped's Latin for beast, as everybody that's gone through the grammar knows, or else where's the use of having grammars at all?"

"Where, indeed!" said Nicholas abstractedly.

"As you're perfect in that," resumed Squeers, turning to the boy, "go and look after *my* horse, and rub him down well, or I'll rub you down. The rest of the class go and draw water up, till somebody tells you to leave off, for it's washing-day to-morrow, and they want the coppers filled."

So saying, he dismissed the first class to their experiments in practical philosophy, and eyed Nicholas with a look, half cunning and half doubtful, as if he were not altogether certain what he might think of him by this time.

"That's the way we do it, Nickleby," he said, after a pause.

Nicholas shrugged his shoulders in a manner that was scarcely perceptible, and said he saw it was.

"And a very good way it is, too," said Squeers. "Now, just take them fourteen little boys and hear them some reading, because, you know, you must begin to be useful. Idling about here won't do."

Mr. Squeers said this, as if it had suddenly occurred to him, either that he must not say too much to his assistant, or that his assistant did not say enough to him in praise of the establishment. The children were arranged in a semicircle round the new master, and he was soon listening to their dull, drawling, hesitating recital of those stories of engrossing interest which are to be found in the more antiquated spelling books.

In this exciting occupation, the morning lagged heavily on. At one o'clock, the boys, having previously had their appetites thoroughly taken away by stirabout and potatoes, sat down in the kitchen to some hard salt beef, of which Nicholas was graciously permitted to take his portion to his own solitary desk, to eat it there in peace. After this, there was another hour of crouching in the school-room and shivering with cold, and then school began again.

It was Mr. Squeers's custom to call the boys together and make a sort of report, after every half-yearly visit to the metropolis, regarding the relations and friends he had seen, the news he had heard, the letters he had brought down, the bills which had been paid, the accounts which had been left unpaid, and so forth. This solemn proceeding always took place in the afternoon of the day succeeding his return; perhaps, because the boys acquired strength of mind from the suspense of the morning, or, possibly because Mr. Squeers himself acquired greater sternness and inflexibility from certain warm potations in which he was wont to indulge after his early dinner. Be this as it may, the boys were recalled from house-window, garden, stable, and cow-yard, and the school were assembled in full conclave, when Mr. Squeers, with a small bundle of papers in his hand, and Mrs. S. following with a pair of canes, entered the room and proclaimed silence.

"Let any boy speak a word without leave," said Mr. Squeers mildly; "and I'll take the skin off his back."

This special proclamation had the desired effect, and a death-like silence immediately prevailed, in the midst of which Mr. Squeers went on to say: "Boys, I've been to London, and have returned to my family and you, as strong and well as ever."

According to half-yearly custom, the boys gave three feeble cheers at this refreshing intelligence. Such cheers! Sighs of extra strength with the chill on.

"I have seen the parents of some boys," continued Squeers, turning over his papers, "and they're so glad to hear how their sons are getting on, that there's no prospect at all of their going away, which of course is a very pleasant thing to reflect upon, for all parties."

Two or three hands went to two or three eyes when Squeers said this, but the greater part of the young gentlemen having no particular parents to speak of, were wholly uninterested in the thing one way or other.

"I have had disappointments to contend against," said Squeers, looking very grim; "Bolder's father was two pound ten short. Where is Bolder?"

"Here he is, please sir," rejoined twenty officious voices. Boys are very like men to be sure.

"Come here, Bolder," said Squeers.

An unhealthy-looking boy, with warts all over his hands, stepped from his place to the master's desk, and raised his eyes imploringly to Squeers's face; his own, quite white from the rapid beating of his heart.

"Bolder," said Squeers, speaking very slowly, for he was considering, as the saying goes, where to have him. "Bolder, if your father thinks that because—why, what's this, sir?"

As Squeers spoke, he caught up the

boy's hand by the cuff of his jacket, and surveyed it with an edifying aspect of horror and disgust.

"What do you call this, sir?" demanded the schoolmaster, administering a cut with the cane to expedite the reply.

"I can't help it, indeed, sir," rejoined the boy, crying. "They will come; it's the dirty work I think, sir—at least I don't know what it is, sir, but it's not my fault."

"Bolder," said Squeers, tucking up his wristbands, and moistening the palm of his right hand to get a good grip of the cane, "you are an incorrigible young scoundrel, and as the last thrashing did you no good, we must see what another will do towards beating it out of you."

With this, and wholly disregarding a piteous cry for mercy, Mr. Squeers fell upon the boy and caned him soundly: not leaving off indeed, until his arm was tired out.

"There," said Squeers, when he had quite done; "rub away as hard as you like, you won't rub that off in a hurry. Oh! you won't hold that noise, won't you? Put him out, Smike."

The drudge knew better from long experience, than to hesitate about obeying, so he bundled the victim out by a side door, and Mr. Squeers perched himself again on his own stool, supported by Mrs. Squeers, who occupied another at his side.

"Now let us see," said Squeers. "A letter for Cobbey. Stand up, Cobbey."

Another boy stood up, and eyed the letter very hard while Squeers made a mental abstract of the same.

"Oh!" said Squeers: "Cobbey's grandmother is dead, and his uncle John has took to drinking, which is all the news his sister sends, except eighteenpence, which will just pay for that broken square of glass. Mrs. Squeers, my dear, will you take the money?"

The worthy lady pocketed the eighteenpence with a most business-like air, and Squeers passed on to the next boy, as coolly as possible.

"Graymarsh," said Squeers, "he's the next. Stand up, Graymarsh."

Another boy stood up, and the schoolmaster looked over the letter as before.

"Graymarsh's maternal aunt," said Squeers, when he had possessed himself of the contents, "is very glad to hear he's so well and happy, and sends her respectful compliments to Mrs. Squeers, and thinks she must be an angel. She likewise thinks Mr. Squeers is too good for this world; but hopes he may long be spared to carry on the business. Would have sent the two pair of stockings as desired, but is short of money, so forwards a tract instead, and hopes Graymarsh will put his trust in Providence. Hopes, above all, that he will study in everything to please Mr. and Mrs. Squeers, and look upon them as his only friends; and that he will love Master Squeers; and not object to sleeping five in a bed, which no Christian should. Ah!" said Squeers, folding it up, "a delightful letter. Very affecting indeed."

It was affecting in one sense, for Graymarsh's maternal aunt was strongly supposed, by her more intimate friends, to be no other than his maternal parent; Squeers, however, without alluding to this part of the story (which would have sounded immoral before boys), proceeded with the business by calling out "Mobbs," whereupon another boy arose, and Graymarsh resumed his seat.

"Mobbs's step-mother," said Squeers, "took to her bed on hearing that he wouldn't eat fat, and has been very ill ever since. She wishes to know, by an early post, where he expects to go if he quarrels with his vittles; and with what feelings he could turn up his nose at the cow's liver broth, after his good master had asked a blessing on it. This was told her in the London newspapers—not by Mr. Squeers, for he is too kind and too good to set anybody against anybody—and it has vexed her so much, Mobbs can't think. She is sorry to find he is discontented, which is sinful and horrid, and hopes Mr. Squeers will flog him into a happier state of mind; with this view, she has also stopped his half-penny a week pocket-money, and given a double-bladed knife with a corkscrew in it to the Missionaries, which she had bought on purpose for him."

"A sulky state of feeling," said Squeers, after a terrible pause, during which he had moistened the palm of his right hand again, "won't do. Cheerfulness and contentment must be kept up. Mobbs, come to me!"

Mobbs moved slowly towards the desk, rubbing his eyes in anticipation of good cause for doing so; and he soon afterwards retired by the side door, with as good cause as a boy need have.

Mr. Squeers then proceeded to open a miscellaneous collection of letters; some enclosing money, which Mrs. Squeers "took care of"; and others referring to small articles of apparel, as caps and so forth, all of which the same lady stated to be too large, or too small, and calculated for nobody but young Squeers, who would appear indeed to have had most accommodating limbs, since everything that came into the school fitted him to a nicety. His head, in particular, must have been singularly elastic, for hats and caps of all dimensions were alike to him.

This business despatched, a few slovenly lessons were performed, and Squeers retired to his fireside, leaving Nicholas to take care of the boys in the school-room, which was very cold, and where a meal of bread and cheese was served out shortly after dark.

There was a small stove at that corner of the room which was nearest to the master's desk, and by it Nicholas sat down, so depressed and self-degraded by the consciousness of his position, that if death could have come upon him at that time he would have been almost happy to meet it. The cruelty of which he had been an unwilling witness, the coarse and ruffianly behavior of Squeers even in his best moods, the filthy place, the sights and sounds about him, all contributed to this state of feeling; but when he recollected that, being there as an assistant, he actually seemed—no matter what unhappy train of circumstances had brought him to that pass—to be the aider and abettor of a system which filled him with honest disgust and indignation, he loathed himself, and felt, for the moment, as though the mere consciousness of his present situation must, through all time to come, prevent his raising his head again.

A LETTER FROM A MAN WE ALL KNOW

A LITTLE girl named Beatrice ("Birdie" for short) lived in Oxford, and she had two dolls—Emily and Mabel. Then a friend gave her a beautiful wax doll which she called Alice.

After a while Emily died. Birdie grieved so much that she needed a little change and went away for a visit. Just why she didn't take Alice, I can't say. Perhaps Alice wasn't invited. All I know is that she received this letter:

My Dear Birdie: I met her just outside Tom Gate, walking very stiffly, and I think she was trying to find her way to my rooms. So I said, "Why have you come here without Birdie?" So she said, "Birdie's gone! and Emily's gone! and Mabel isn't kind to me!" And two little waxy tears came running down her cheeks.

Why, how stupid of me! I've never told who it was all the time! It was your own doll. I was very glad to see her, and took her to my room, and gave her some Vesta matches to eat, and a cup of nice melted wax to drink, for the poor little thing was very hungry and thirsty after her long walk. So I said, "Come and sit by the fire and let's have a comfortable chat."

"Oh, no! no!" she said, "I'd *much* rather not; you know I do melt so *very* easily!" And she made me take her quite to the other side of the room, where it was *very* cold; and then she sat on my knee and fanned herself with a pen-wiper, because she said she was afraid the end of her nose was beginning to melt.

"You have no *idea* how careful we have to be—we dolls," she said. "Why, there was a sister of mine—would you believe it?—she went up to the fire to warm her hands, and one of her hands dropped right off. There now!"

"Of course it dropped *right* off," I said, "because it was the *right* hand."

"And how do you know it was the *right* hand, Mr. Carroll?" the doll said.

So I said, "I think it must have been the *right* hand because the other hand was *left*."

The doll said, "I shan't laugh. It's a very bad joke. Why, even a common wooden doll could make a better joke than that. And besides, they've made my mouth so stiff and hard that I *can't* laugh if I try ever so much."

"Don't be cross about it," I said, "but tell me this: I'm going to give Birdie and the other children one photograph each, whichever they choose; which do you think Birdie will choose?"

"I don't know," said the doll; "you'd better ask her!"

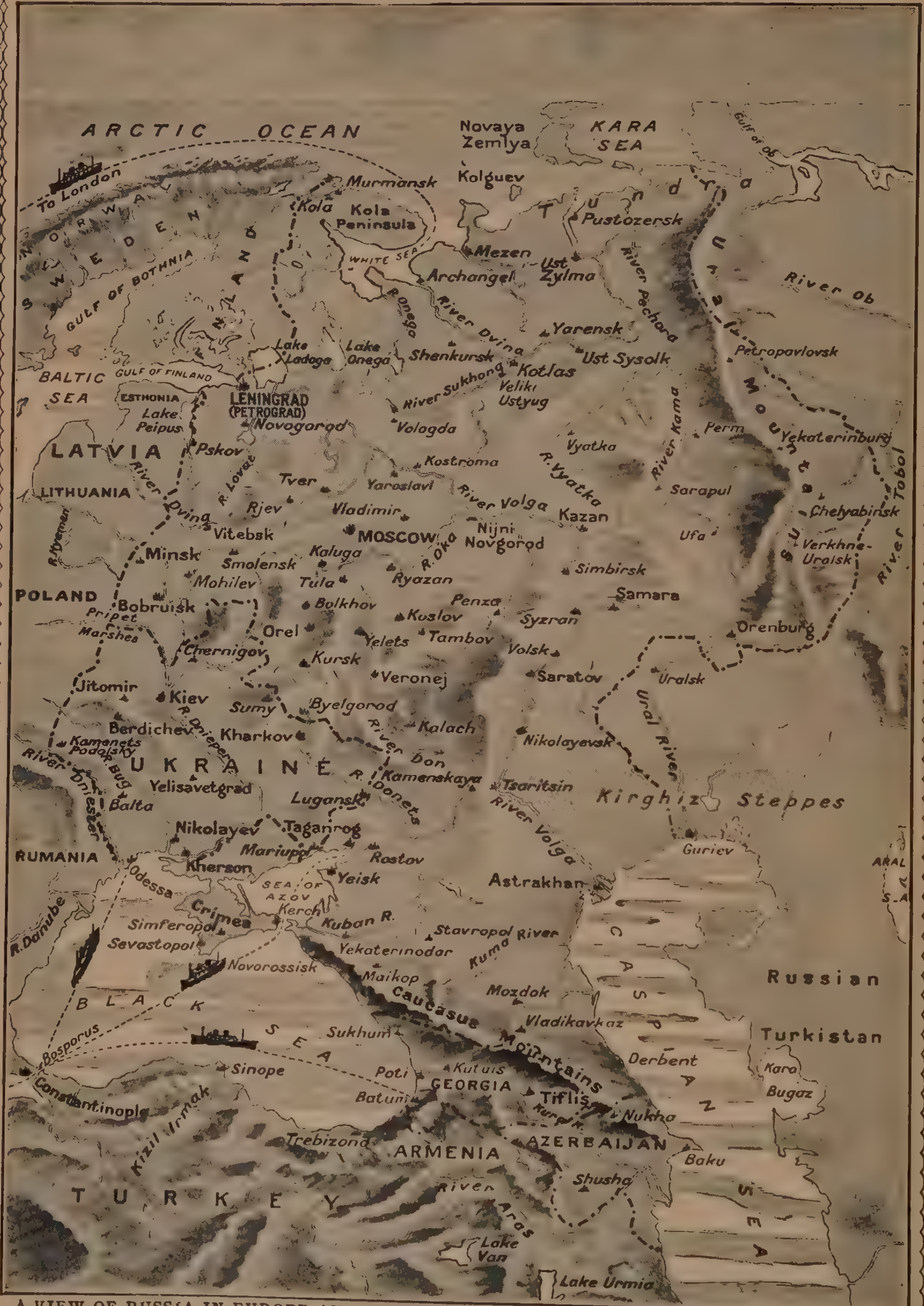
So I took her home in a hansom cab.

Your affectionate friend,

Lewis Carroll.

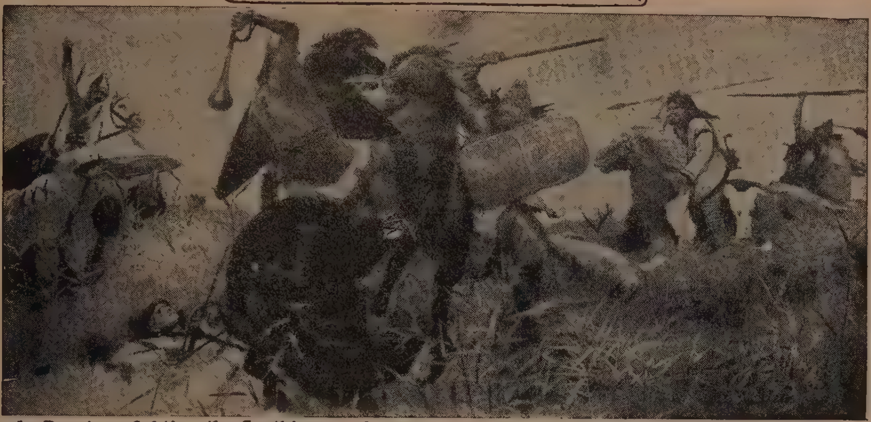
THE NEXT STORIES ARE ON PAGE 5755.

THE SHRUNKEN RUSSIA OF TO-DAY


ARCTIC OCEAN
Novaya Zemlya
KARA SEA
Gulf of Ob
To London
NORWAY
SWEDEN
FINLAND
Murmansk
Kola
Kola Peninsula
Kolguev
Tundra
Pustozersk
Ural
GULF OF BOTHNIA
WHITE SEA
Mezen
Archangel
Ust Zylma
Onega
River Dvina
River Pechora
River Ob
Yarensk
Lake Ladoga
Lake Onega
Shenkursk
Kotlas
Ust Sysolk
Petropavlovsk
BALTIC SEA
GULF OF FINLAND
ESTHONIA
LENINGRAD (PETROGRAD)
River Sukhona
Veliki Ustyug
Lake Peipus
Novogorod
Vologda
River Kama
Perm
Mountains
Yekaterinburg
LATVIA
Pskov
Vyatka
Kostroma
R. Vyatka
River Tobol
R. Lovat
Tver
Yaroslavl
River Volga
Kazan
Sarapul
LITHUANIA
River Dvina
Rjev
Vladimir
Chelyabinsk
R. Niemen
Vitebsk
MOSCOW
R. Oka
Nijni Novgorod
Ufa
Verkhne-Uralsk
Minsk
Smolensk
Kaluga
Simbirsk
Mohilev
Tula
Ryazan
Samara
POLAND
Bobruisk
Bolkhov
Penza
Pripet Marshes
Kuslov
Syzran
Orenburg
Orel
Yelets
Tambov
Volsk
Chernigov
Kursk
Saratov
Uralsk
Jitomir
Kiev
Veronej
Sumy
Byelgorod
Ural River
Berdichev
R. Dnieper
Kharkov
Kalach
River Don
Nikolayevsk
Kamenets Podolsky
River Dniester
Bug
UKRAINE
R. Donets
Kamenskaya
Tsaritsin
Kirghiz Steppes
Yelisavetgrad
Balta
Lugansk
River Volga
Nikolayev
Taganrog
Guriev
RUMANIA
Kherson
Mariupol
Rostov
ARAL SEA
Odessa
SEA OF AZOV
Yeisk
Astrakhan
R. Danube
Crimea
Kerch
Kuban R.
Simferopol
Stavropol
Kuma River
Sevastopol
Yekaterinodar
CASPIAN SEA
Novorossisk
Maikop
Russian Turkistan
BLACK SEA
Caucasus Mountains
Mozdok
Vladikavkaz
Bosporus
Sukhum
Derbent
Kara Bugaz
Sinope
Poti
Kutais
Constantinople
GEORGIA
Tiflis
Batum
Kura R.
Nukha
Kizil Irmak
Trebizond
ARMENIA
AZERBAIJAN
Baku
Shusha
TURKEY
River Aras
Lake Van
Lake Urmia

A VIEW OF RUSSIA IN EUROPE AND THE UKRAINE, WITH CITIES, RIVERS AND MOUNTAINS

The Revolution cost Russia a territorial loss of 350,000 square miles and a population of 50,000,000. In addition to Finland and Poland, which have been definitely set up as independent governments, there are now the free states of Esthonia, Latvia and Lithuania.



Early Russians fighting the Scythians, a fierce race of barbarians who lived around the Black Sea.

RUSSIA AND ITS STORY

OVER a thousand years ago, when legend was merging into history, we first hear of Russia.

Then it was a land of mixed tribes badly governed, and feeling that it needed order first of all things. In those days the roving Northmen were the world's boldest men, and to them the Russian tribes living around Novgorod, within reach of the Baltic Sea, sent a message: "Our land is great and bountiful, but there is no order in it. Come and rule over us." Three bold Viking brothers responded to the invitation, and crossed over from Scandinavia. Rurik, the chief of the brothers, founded a line of kings, and for centuries Russian rulers proudly claimed to be descended from him.

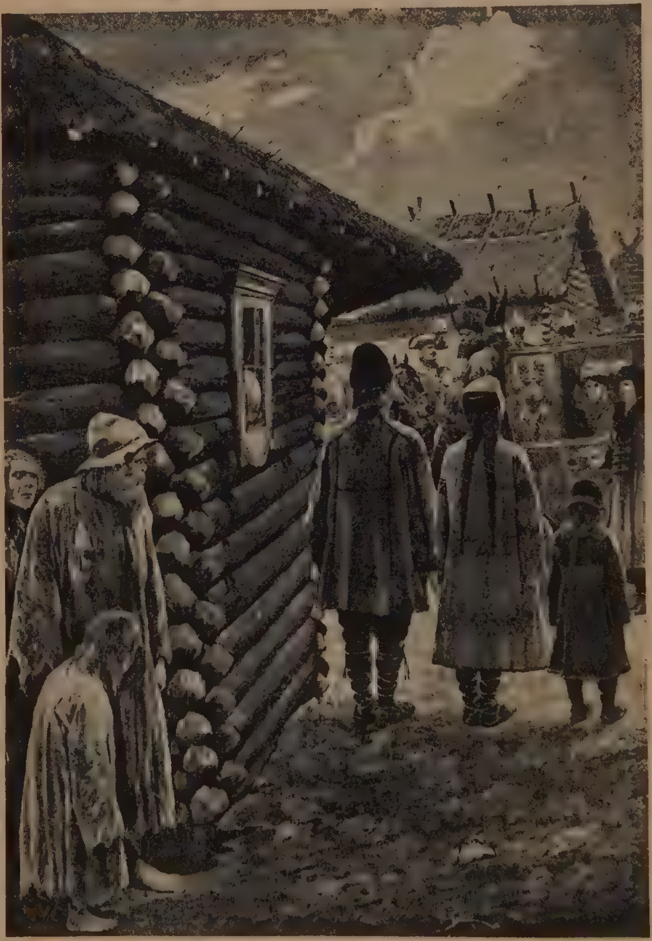
Vladimir was the first Christian ruler, toward the end of the tenth century. He chose to belong to the Eastern, or Greek, Church, and ever since Russia has been faithful to that branch of the Church. Often she has held out a helping hand to smaller countries of Slavonic origin like herself, who were oppressed by their Mohammedan masters.

But civil war followed for centuries. The country was divided into rival principalities, and the more powerful among them, Novgorod, Kiev and, later, Moscow, struggled for leadership. This strife within the country was partly, but not entirely, checked by danger from the outside. In 1222 hordes of Mongols or Tartars, nomads from the deserts and steppes of Asia, descended on the country, and for more than two hundred years Russia was obliged to recognize them as conquerors, pay heavy taxes, and from time to time be plundered by fresh invaders. The most dreaded of these invasions, by what was called the Golden Horde, came from the valley of the Amur, in eastern Siberia. Moscow was taken and burned by the Tartars more than once.

As time went on the Russians gradually regained their independence. Ivan III, who reigned as Duke of Muscovy in the latter part of the fifteenth century, refused to do homage to the Tartar ruler and founded the modern Russian state. He rebuilt Moscow. By this time the double-headed black eagle, used by the Greek Empire, had been adopted as the arms of Russia.

Ivan IV was called Ivan the Terrible, because he was so insanely cruel; but he was also a man of great power. Born in 1530, he took the title of tsar of all Russia in 1547, after he had been a boy king from the age of three.

He annexed many cities and states on the great Russian plain, till his dominions reached Astrakhan on the Caspian Sea, and stretched northward as far as the White Sea and Siberia. He began trade with England through Archangel; and he hoped to force a way to the Baltic Sea, but Poland and Sweden blocked his path westward. Ivan used the Cossacks to defend the eastern frontier of his realm, and it was a Cossack leader that conquered a large part of Siberia for him. In central Russia Ivan stamped out every sign of opposition with a relentless cruelty that was not seen again in the land till the Bolshevists of modern times.



Poor peasants hidden from the sight of the Empress Catherine as she drove through the villages of Russia.

After Ivan died, in 1584, disorder followed. One consequence of his wars was the reducing of the peasantry to a state of serfdom, which lasted for three hundred years. The laborers were so lessened in numbers that the landowners competed for their services, and they were strictly forbidden to leave the estate on which they had been born. This order left them in a condition approaching slavery. They had rights of tillage in the common land of the place, but they had to give their services for the cultivation of the estates of the landed owners, and they could not go elsewhere.

After about thirty years of disorder and war following the death of Ivan the Terrible, during which the Poles occupied Moscow and the Swedes Novgorod, the Russians rose in despair. They drove out the invaders, and called a National Assembly together, which elected as tsar Michael Romanoff, the first sovereign of a new line. This was done in 1613, and the Romanoffs, chosen by the common consent of the people, continued to reign till 1917, when Tsar Nicholas II abdicated in favor of a republic. Later he and all his family were murdered brutally.

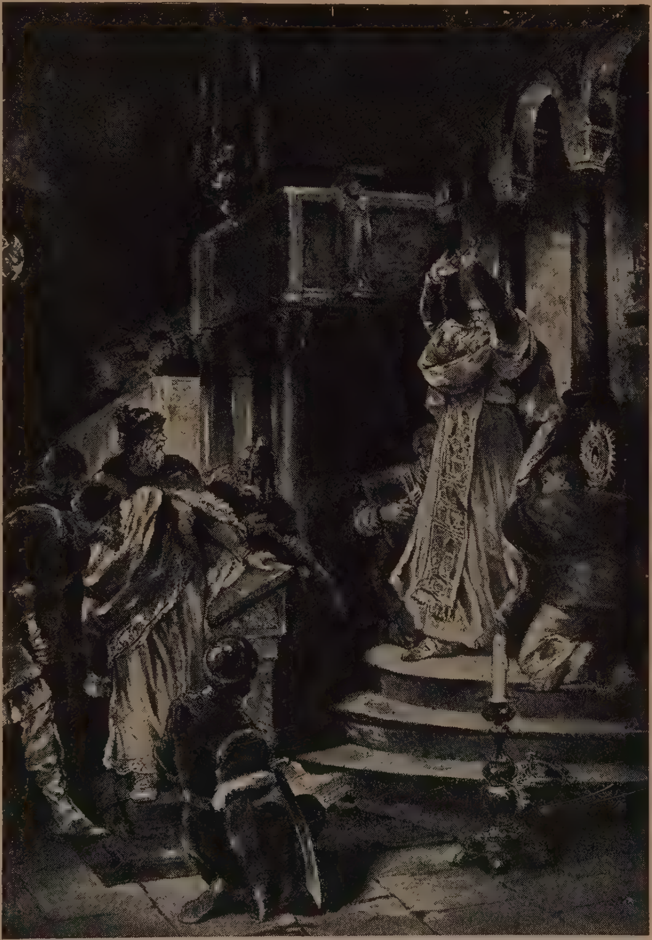
The most famous ruling member of the Romanoff family was Peter the Great, who began to reign when he was seventeen, and reigned from 1689 to 1725. Peter was determined to have his own way, and, happily, in some respects it was a good way. As a child he was fond of boats and mechanical contrivances, and he perceived how backward his country was in these respects.

He went abroad to Holland and England, and later to other countries, and worked himself as a boat-builder. Then he returned to Russia and began to introduce some of the improvements he had seen in other lands, greatly to the disgust of many of his people. Living a remote life far away from other countries, and surrounded by races as simple and rough as themselves, the Russians naturally clung fast to their old customs; but Peter determined to make them change. It was a national habit to grow a beard, and many simple-minded people thought it wrong to cut the beard or hair. But Peter made his chief officials shave, as part of his plan for breaking up the national habits and giving fresh ideas a chance. He began by cutting off the beards of his principal officers himself. Afterward a tax was put on beards.

It must not be supposed that Peter himself was much more civilized than his people. He was coarse, boisterous, and as tyrannical in spirit as most of the Russian rulers had been; but he saw that Russia needed certain things if she was to take her place among the leading nations. He tried to give her these things, even if he had to thrust them on her.

He tried to bring knowledge to the country through books, libraries and museums. He brought in foreigners to train Russian rulers. He extended the means of travel and of trade by making canals. He also gave Russia the beginnings of a navy, first on the White Sea and then on the Sea of Azov. His next dream of conquest was to make himself emperor of the East, but Turkey blocked his way. Northward, however, after the death of Charles XII of Sweden, with whom he engaged in long wars with varying success, he forced Sweden from the eastern shores of the Baltic and made that sea the chief Russian outlet to the west. He then built the city of St. Petersburg (afterward Petrograd and then Leningrad) as his capital.

Peter the Great found Russia a half-savage nation on the outskirts of Europe; he left it a nation that henceforward had to be reckoned with as a European power almost in the first rank. The change was entirely due to his overmastering self-will and energy. As a man he showed no pity to any who stood in his way, following the grim Russian and Turkish belief that the dead give no further trouble. His power over the Russian people was shown by their acceptance, for a time, in spite of all their customs, of his second wife, Catherine, to reign after him as empress, though she was a peasant. In the next seventy years, besides Catherine I, three other women, Anne, Elizabeth and Catherine II ruled over Russia. Peter II ruled for three years only.



The Metropolitan Philip refuses to give his blessing to Ivan the Terrible.

Catherine II, a German woman, who is often called Catherine the Great, ruled for thirty-four years—till 1796. She usurped the throne after her husband, Peter III, was murdered, and held the position by sheer force of character and statesmanlike ability, though her private life was wicked. Catherine followed the plan of Peter the Great by bringing to her court foreigners with helpful ideas. Her ambition could never be satisfied, and she made large additions to her empire, including the Crimea, taken from the Turks; the Black Sea region round Odessa; what is now the Lithuanian coast, on the Baltic; and a large share of Poland.

In the reign of Catherine's son Paul, a weak man who was fascinated by Napoleon and wished to join him in an attempt to divide the Turkish Empire and then conquer India, another province was voluntarily given by its prince to Russia. This was the ancient kingdom of Georgia, beyond the Caucasus Mountains. The emperor Paul was assassinated, and the accession of his son, Alexander I, in 1801, opened the modern period of Russian history in which the country began to play a leading part in the history of Europe as a whole.

At first Alexander was inclined to act with Napoleon, if he could have his full share of influence throughout Europe, but presently he recognized that there was no room in Europe for two autocrats. Then Russia, next to England, became Napoleon's most persistent enemy. It was Russia's resistance to Napoleon's Moscow campaign, and her following-up of his defeated army that led to the overthrow of the world's greatest adventurer. It was Alexander, prompted by Stein, the great Liberal statesman exiled from Prussia, who pushed the Allies' pursuit through the gates of Paris.

THE HIGH IDEALS WITH WHICH A TSAR BEGAN HIS REIGN

Early in his reign Alexander had been alive to the need for more freedom in Russia, through improved education, more just government, possibly on constitutional lines, and the overthrow of the serf system. But when the armies of the European monarchies had crushed Napoleon and placed France again under the tyranny of the Bourbon family, he went back to the view that all nations, including Russia, would be happier under the government of rulers like himself than under any new-fangled schemes of liberty and self-control. But Russia had now come into the family of European nations, and many of her younger men knew the difference between Russian tyranny and the freedom of the West. The result was that disappointment showed itself in the underground form of secret societies plotting to bring about changes which could not be sought openly. This evil troubled Russia during the next hundred years.

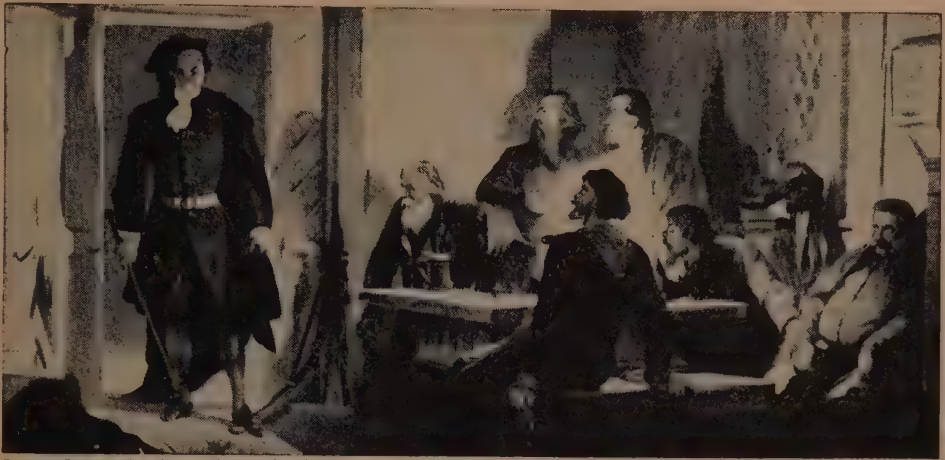
Alexander was succeeded in 1825 by his younger brother Nicholas, a hard, soldierly man who would stand no nonsense about liberty, as he regarded it. For thirty years he sternly discouraged all expressions of public opinion about the government of the Russian people. He equally disliked liberty in other countries and helped the emperor of Austria to crush rebellion among his Hungarian subjects. Nicholas did useful work in securing self-government for Wallachia and Moldavia (now the central parts of Rumania) and Serbia from the Turks, and the beginnings of freedom for Greece. But he pushed his opposition to Turkey so far that finally Great Britain and France supported Turkey against him in the unnecessary and badly managed but bravely fought Crimean War. During the reign of Nicholas the Russians were often at war completing the conquest of the brave Circassians.

THE HUMANE DECREE WHICH GAVE MILLIONS OF SERFS THEIR FREEDOM

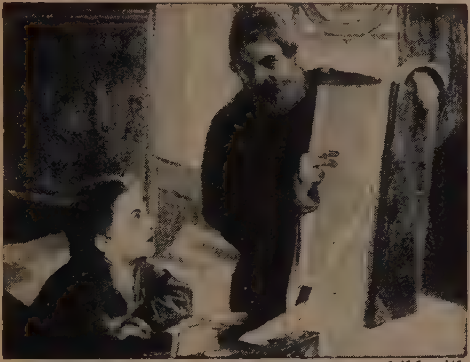
The successor to Nicholas, Alexander II, was the only ruler Russia has ever had who tried sympathetically to reform her government and give her the institutions of a free country. In 1861 a decree was issued freeing within two years all the serfs in the empire. They numbered 23,000,000, and their joy at release from a miserable and unmanly slavery was reflected round the world. Steps were also taken to establish a form of local government, and trial by jury was instituted. Attempts were made to develop the industries of the country. Tsar Alexander II was the popular national hero.

But disappointment followed. Prosperity did not come as swiftly as was expected. More reforms were asked for hastily, and were not granted. Secret societies again became active, and were repressed. Then murders of officials became common. Spying and counterspying spread everywhere, and finally Alexander II, who had been hailed twenty years before as the savior of his country, was murdered by a bomb thrown under his carriage as he rode through the streets of St. Petersburg. This barbarous act of course put back the cause of freedom and cooled the sympathy of other nations.

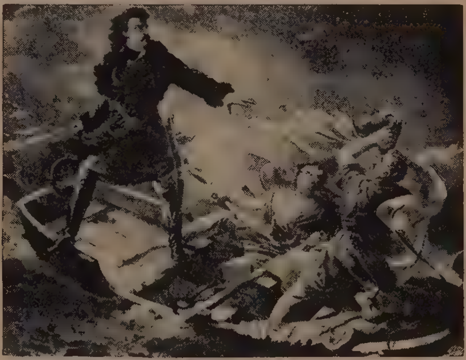
THE GREAT TSAR PETER, MAKER OF RUSSIA



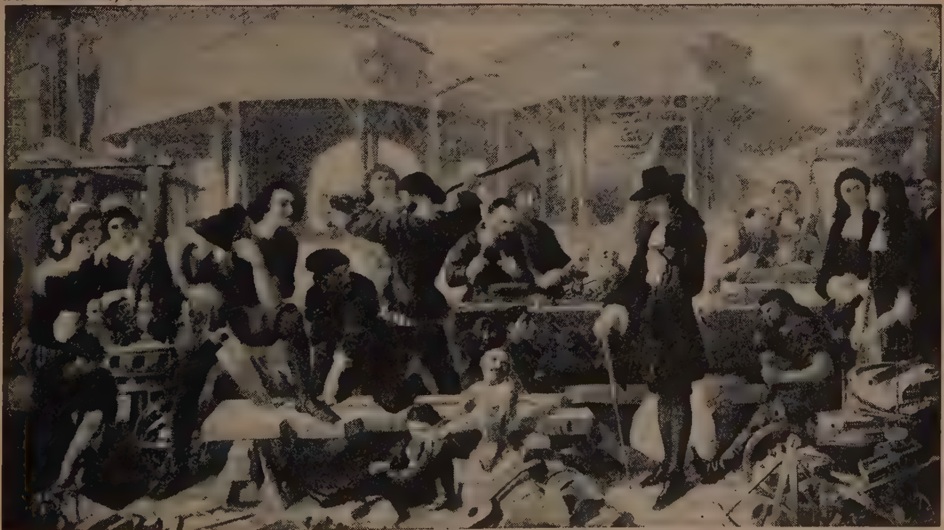
When Peter the Great determined to travel in Europe, the Streltsi, a regiment of pampered and bigoted guards, conspired against him. Peter discovered the plot and visited the conspirators unarmed, as seen here.



In this picture we see Peter the Great as a child with his teacher. While he was quite young the teacher was removed, and Peter wasted all his time at play.



Peter the Great was fond of the sea, and had almost a mania for shipbuilding. Here we see him standing in a small boat upon the sea in a fierce tempest.



Peter went to England and lived for a time at Deptford, where he dressed as a workman and studied shipbuilding in all its branches. During his stay on the Thames King William III visited Peter, as shown here.

HOW BRITAIN STOOD IN THE WAY OF RUSSIA'S ADVANCE TO THE EAST

During Alexander's reign, by the help of the Russian army, Bulgaria obtained freedom from the Turks, but the Russians were prevented from entering Constantinople by the threats of Great Britain and Austria. The British at that time were very suspicious of Russia's widespread conquests in central Asia and her advance toward India.

The successor of Alexander II, his son Alexander III, had no sympathy with what his father had done. He thought that the extension of greater liberty to the Russian people had been a failure, and he returned to the stern methods of government of the earlier tsars.

THE TERRIBLE MAN WHO BANISHED THOUSANDS TO SIBERIA

His method of government was largely by his secret police. Those who opposed his repressive ways were sent to imprisonment in Siberia by tens of thousands. This third Alexander's interference with his people extended to all their interests in life. Russians who believed in other religions than that of the Greek Orthodox Church were persecuted. The many nationalities that are contained in Russia were not allowed to use their own languages. The Russian language and Russian customs were enforced everywhere in all official doings. The aim was to make Russian all races in Russia. So discontent spread throughout the land, and secret societies favoring revolution increased. Tsardom became a hated byword. Jealousy also sprang up between Russia and Germany, and this led to France and Russia drawing closer together in friendship, till at last they were pledged allies. Meanwhile Great Britain insisted that Russia should agree with her on a fixed boundary in central Asia which Russia must not cross, as it was felt that India was being continually threatened from the north.

This was the state of things when Alexander III died, and the last of the Romanoff rulers, Nicholas II, became tsar in 1894. He was a very amiable but weak man, and he followed in the steps of his father. His sympathies were with the people, but his advisers recommended him to be strong and stern, and his wife, who had a great influence over him, sided with them. The revolutionary societies that used murder as a weapon revived.

THE LITTLE EASTERN NATION WHICH FLUNG BACK THE RUSSIAN GIANT

Meanwhile, Russia had sent armies to the Pacific coast across Siberia and had erected a great fortress there at Port Arthur. The immense Chinese province of Manchuria, joined with European Russia by the Trans-Siberian railway, had fallen entirely under Russian influence, while Korea was threatened. The warlike Japanese became deeply stirred. They saw a giant power coming nearer and nearer, with what looked like irresistible force. Suddenly they declared war, and flung themselves on the outpost of the great Russian Empire.

The result astonished the world. On land and sea the Japanese were everywhere victorious. The Russian fleet was utterly destroyed. The great fortress was besieged, stormed and taken. The Russian armies were flung back in great and terrible battles, and the Russian threat to the Far East was completely dispelled. The Japanese had fought as a united nation bent on freeing itself from a great near-by danger. The Russians, disunited at home, were half-hearted in the war and became discouraged and disorganized by failure. Russia at home was thrown into confusion. Government was at a standstill. Anything might happen. Then the cry for a real parliament arose.

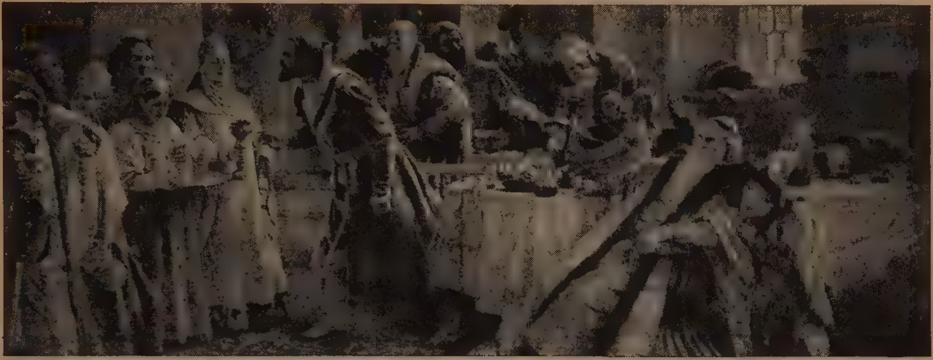
THE TREMENDOUS CHANGE THAT TOOK PLACE IN RUSSIA'S CONSTITUTION

A promise of a representative government was made by the tsar at the same time that peace was signed with Japan (October, 1905), and the first parliament met in April of the next year; but from that time onward the meetings showed that the members were given to mistaking talking for business. The actual power of the Duma, as the parliament was called, was very small, and its decisions might be ignored by the tsar.

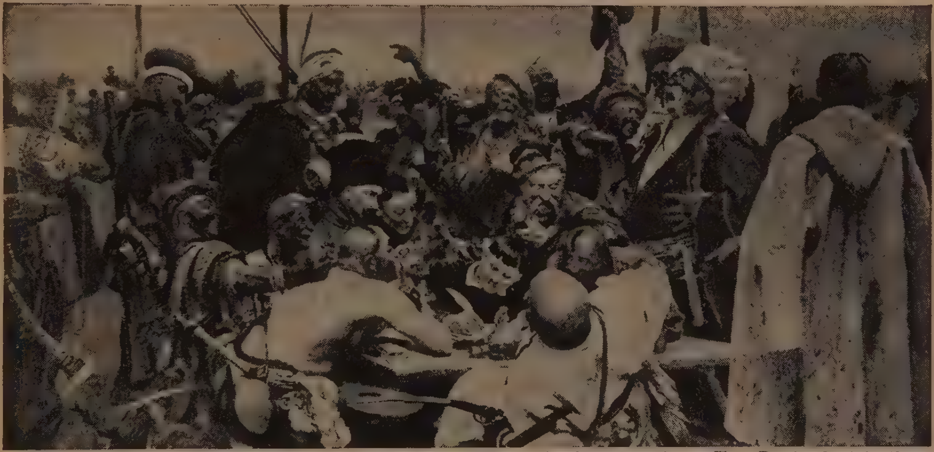
During the World War the tsar, finding that he had not the confidence of the Duma, while the people were discouraged by great losses and the mismanagement of military affairs, resigned. An attempt to form a republican government by Alexander Kerensky failed, and in November, 1917, a soviet communist government was formed with the help of Germany. The tsar and his family were captured by the Bolshevists, and on July 16, 1918, were cruelly murdered.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 5847.

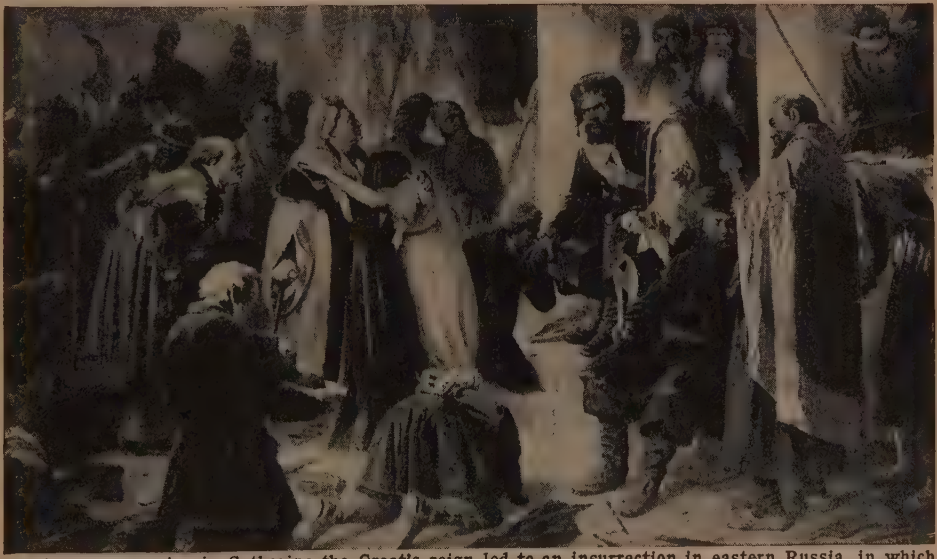
IN RUSSIA IN THE OLDEN DAYS



The Ceremony of the Kiss, by the Russian artist Makovski, shows a sixteenth-century noble lady bringing a cup of wine to her guest of honor. When he has drunk the wine, she will kiss him.

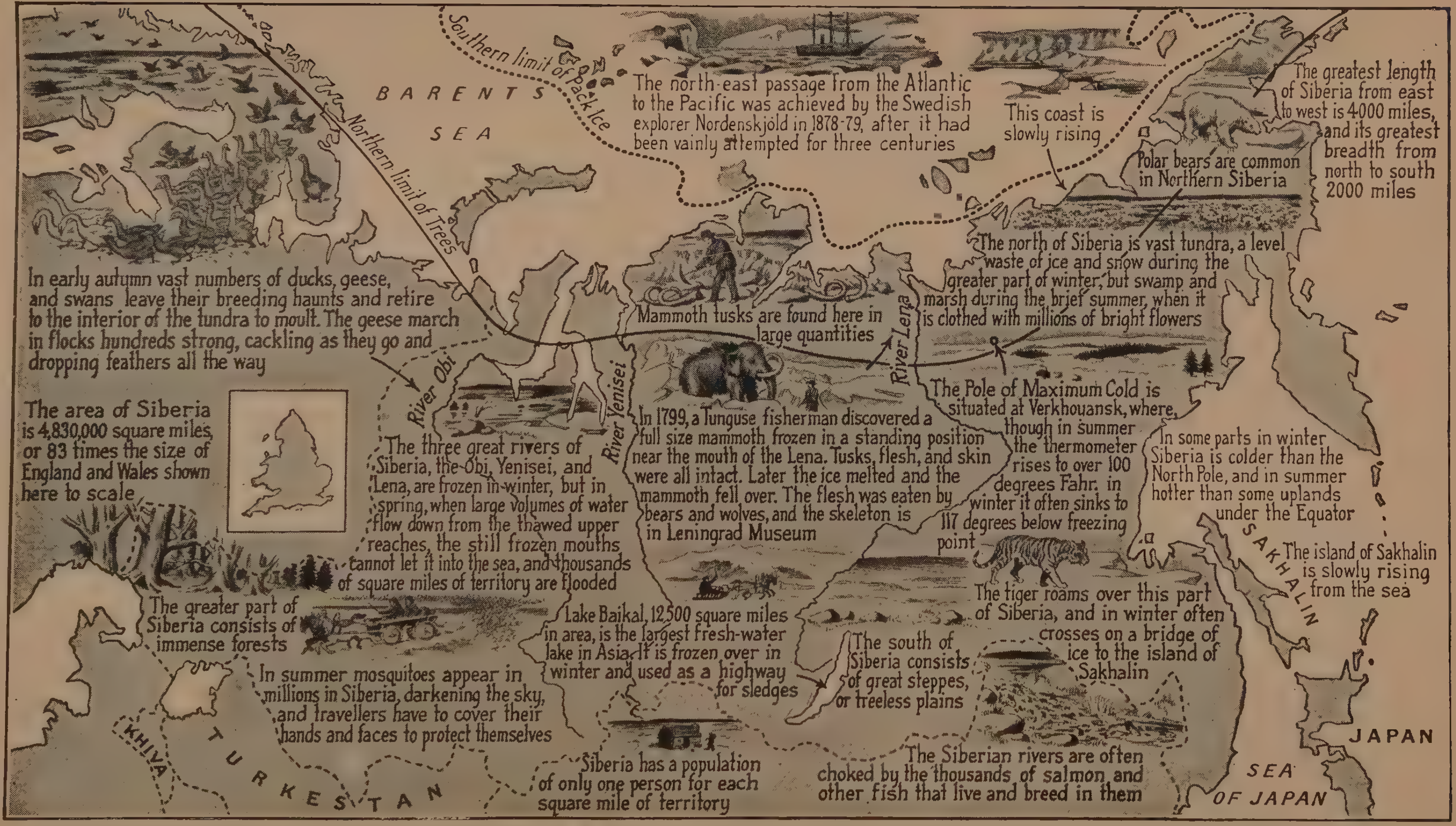


In his picture, The Cossacks Write a Letter to the Sultan, the famous painter Ilya Repin depicts these Russians sending a fierce reply to Mohammed IV, who claimed sovereignty over them about 1670.

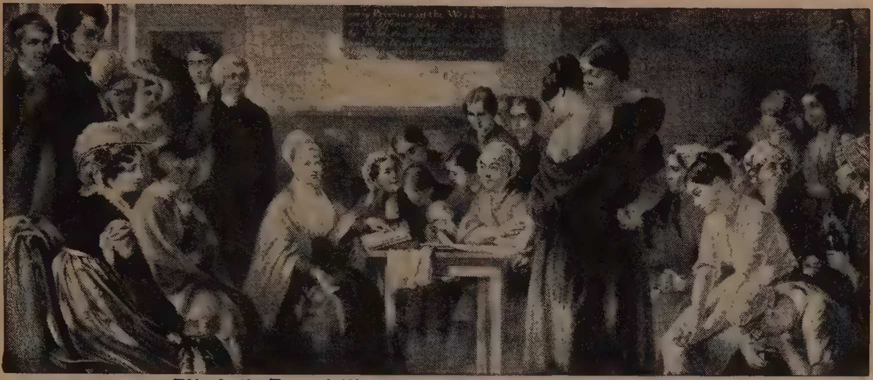


The bitter oppression in Catherine the Great's reign led to an insurrection in eastern Russia, in which a Cossack named Pugatchev, shown here, became leader, and pretended to be the dead Tsar Peter III.

THE SPACIOUS COUNTRY OF SIBERIA WITH GREAT WEALTH & FEW PEOPLE


Southern limit of Pack Ice
BARENTS SEA
Northern limit of Trees
The north-east passage from the Atlantic to the Pacific was achieved by the Swedish explorer Nordenskjöld in 1878-79, after it had been vainly attempted for three centuries
This coast is slowly rising
The greatest length of Siberia from east to west is 4000 miles, and its greatest breadth from north to south 2000 miles
Polar bears are common in Northern Siberia
The north of Siberia is vast tundra, a level waste of ice and snow during the greater part of winter, but swamp and marsh during the brief summer, when it is clothed with millions of bright flowers
In early autumn vast numbers of ducks, geese, and swans leave their breeding haunts and retire to the interior of the tundra to moult. The geese march in flocks hundreds strong, cackling as they go and dropping feathers all the way
Mammoth tusks are found here in large quantities
River Lena
River Obi
River Yenisei
The Pole of Maximum Cold is situated at Verkhoyansk, where, though in summer the thermometer rises to over 100 degrees Fahr. in winter it often sinks to 117 degrees below freezing point
In some parts in winter Siberia is colder than the North Pole, and in summer hotter than some uplands under the Equator
The area of Siberia is 4,830,000 square miles, or 83 times the size of England and Wales shown here to scale
The three great rivers of Siberia, the Obi, Yenisei, and Lena, are frozen in winter, but in spring, when large volumes of water flow down from the thawed upper reaches, the still frozen mouths cannot let it into the sea, and thousands of square miles of territory are flooded
In 1799, a Tunguse fisherman discovered a full size mammoth frozen in a standing position near the mouth of the Lena. Tusks, flesh, and skin were all intact. Later the ice melted and the mammoth fell over. The flesh was eaten by bears and wolves, and the skeleton is in Leningrad Museum
SAKHALIN
The island of Sakhalin is slowly rising from the sea
The tiger roams over this part of Siberia, and in winter often crosses on a bridge of ice to the island of Sakhalin
The greater part of Siberia consists of immense forests
Lake Baikal, 12,500 square miles in area, is the largest fresh-water lake in Asia. It is frozen over in winter and used as a highway for sledges
The south of Siberia consists of great steppes, or treeless plains
In summer mosquitoes appear in millions in Siberia, darkening the sky, and travellers have to cover their hands and faces to protect themselves
KHIVA
TURKESTAN
Siberia has a population of only one person for each square mile of territory
The Siberian rivers are often choked by the thousands of salmon and other fish that live and breed in them
JAPAN
SEA OF JAPAN

SIBERIA IS A COUNTRY OF AMAZING CONTRASTS. IN WINTER IT HAS THE COLDEST CLIMATE IN THE WORLD, AND IN SUMMER IT IS HOT



Elizabeth Fry visiting the prisoners in Newgate Prison.

TWO PIONEER WOMEN

HERE are the stories of two women. Cruelties practiced in prisons only a hundred years ago seem unbelievable to-day. They were stopped chiefly by Elizabeth Fry. Less than a hundred years ago soldiers were allowed to die of disease in insanitary barracks as if men were no more than flies. That was stopped chiefly by Florence Nightingale. The movements begun in England by those two women spread over the world.

In those days public opinion was far from enlightened; women had much less power than they have to-day; prejudice was stronger, and tyranny was unashamed; yet these two women lifted civilization forward.

In the eleventh century the lords of Gournay-en-Brai left Normandy for England. In return for their services William Rufus granted them land in Norfolk, and they in their turn repaid their debt to England when, in 1780, Elizabeth Gurney was born at Earlham Hall, about two miles from Norwich.

In the days of George Fox one of the Gurneys had become a Quaker, and Elizabeth's parents attended their meetings, although they wore ordinary clothes, and rode, danced, and studied music.

At seventeen Elizabeth was a tall attractive girl who loved dancing and rode to perfection. The cathedral city was a centre of pleasant society. Troops were quartered there; Prince William Frederick appeared at the balls, and Mrs. Opie held a little court of people who loved literature.

Elizabeth naturally enjoyed these things, but she confided to her journal that she was not altogether at peace with herself. She wrote: "I must not flirt; I must not be out of temper with the children. I must not exaggerate. I am more cross, more proud, more vain, more extravagant. I do believe if I had a little true religion I should have a greater support than I have now, but I have the greatest fear of religion, because I never saw a person religious who was not enthusiastic."

Elizabeth was restless, as all intelligent people must be till they have worked out a plan of life, but she had a wholesome dread of hysteria and cant.

One morning carriages set off from Earlham bearing all the Gurneys to Meeting in Norwich. Elizabeth went seldom, her delicate health being a useful excuse, but a famous American Quaker was to be present, and the whole family hoped to hear him speak. The seven sisters drove in, no doubt talking of meets, balls and novels;

they drove back in silence, with a weeping Betsey in their midst. She tried to tell them that she was not unhappy, only deeply shaken by a strange thing that had happened to her. As William Savery was speaking she suddenly "knew there was a God." It was as if one of the far-away, pinpoint stars had all at once appeared in its true size, dazzling by its glory. What she had half believed she now knew.

Elizabeth felt it impossible to live in the old way. She wished to become what was called a Plain Quaker, and devote all her time to the service of the oppressed. But her wise father, before he would let her renounce the world, insisted that she should see it. Elizabeth was taken to London, introduced to fashionable and witty society, escorted to operas and theatres, and driven about the parks. Almost every night she had a curious dream of being washed away by the sea and tasting all the horrors of drowning. After she had finally decided to devote her life to the service of others the dream came no more.

THE BEAUTIFUL RICH GIRL AND HER NOBLE WORK FOR THE POOR

At nineteen she returned home and set up a school for poor children. In those days education was the privilege of the rich, but Elizabeth thought each man and woman had as much right to read as they had to breathe.

Her shyness made her shrink from the Plain Quaker's queer way of speech and peculiar dress, but she gave up her feathered hat and scarlet habit for a drab gown and a white cap, and she defended herself from stares and smiles with the best courage she could muster.

When she was twenty Elizabeth was wooed by a Plain Quaker named Joseph Fry, who had a large business in London. For some time she hesitated, but her lover persuaded her that she could serve the poor married as well as single, and the wedding took place. She became a most devoted, tender and conscientious mother to a large family, but she also found time to seek out the sick poor and care for them. She explored the foul alleys and courts of old London. Later, when her father-in-law died and the family inherited Plashet House in Essex, she set up a school and a soup kitchen there, cared for the gipsies who camped near by, and worked with a Catholic priest to improve the lot of some miserable Irish people who had colonized a neighboring village, where they lived in squalor and want.

Although she loved her country home and her occupations there, the Frys had from time to time to visit London, and on one of these visits she met some Quakers who had been to Newgate. They described how a double row of railings shut off the prisoners, who fought like wild beasts to get near the visitors, screaming for charity, stretching out begging hands, and looking, in their wretchedness, barely human.

THE TERRIBLE SCENES THAT STIRRED THE HEART OF ELIZABETH FRY

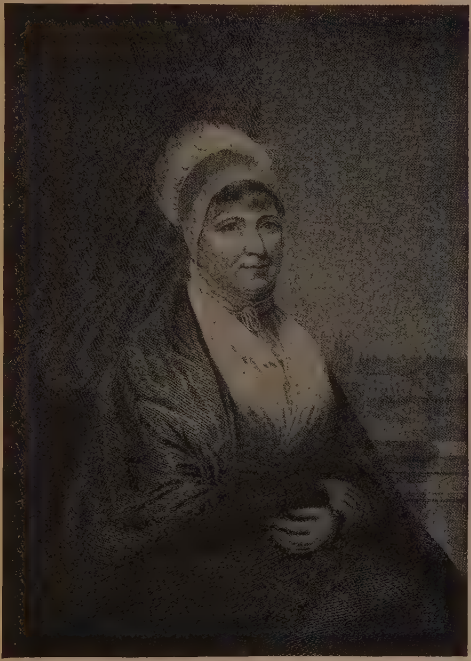
Elizabeth Fry at once went off to see whether she could help these miserable people. That was in 1813, and three years passed before she began to work there regularly. They were years filled with illness, money troubles and bereavements, the greatest of her sorrows being the loss of a little daughter five years old. Yet she never forgot the terrors she had seen in Newgate, and as soon as her family duties allowed her she returned to it.

Before we describe what Mrs. Fry discovered, let us remember that in those days the English laws were extremely harsh. Men could be hanged for forgery, smuggling, cattle-stealing, cutting timber, poaching, shop-lifting, and many other offenses. One example will suffice to prove their savage injustice. The press gang seized a young man and carried him off to serve in the navy. His wife and baby were left penniless. She stole a piece of cloth valued at five shillings, which she hoped to sell for food, and the country which had taken away the breadwinner hanged his wife!

THE UNJUST LAW THAT HELD AN INNOCENT MAN IN PRISON

It is easy to realize that the jails were crowded not only with real criminals, but with respectable people who had been driven to some petty offense by sheer want. At that time the British Parliament had passed a bill saying that innocent prisoners should be released without having to pay the heavy fees demanded by the jailers. Otherwise a poor man might never have come out of prison, though he were proved not guilty a dozen times over.

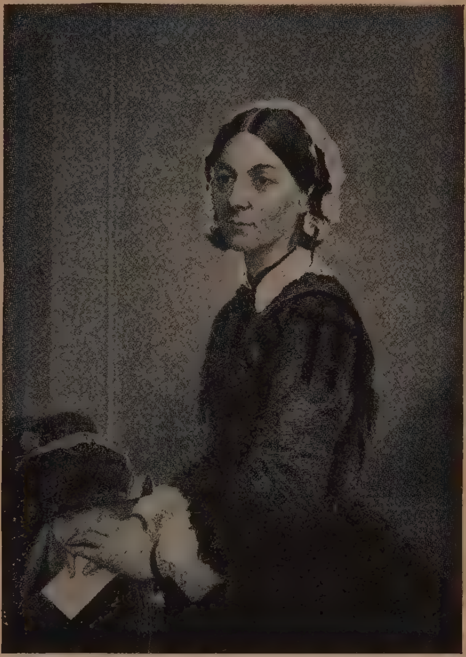
The prisons were sometimes old dungeons thirty steps below the earth, slimy, and swarming with rats. Chains, iron collars and logs were used to secure the prisoners. Torture was forbidden by law, but sometimes practiced by brutal jailers. There was no regular allowance of food, clothing was not supplied, and in Newgate the women slept huddled together on the floor, where the boards were raised in one part to serve as a pillow, though no bedding was allowed. They were literally half naked, for want had brought them there, and they were obliged to trade their poor garments for bread. Their friends, to feed them, had to steal, and soon came to swell the number condemned to death. In those days the women's division of Newgate consisted of two cells and two wards, a small area of 190 square yards which held three hundred women, tried and untried, who were controlled by two men.



Elizabeth Fry, who led a prison-reform movement which spread over the civilized world.

Sometimes, when they were tired of sentencing women to the gallows, magistrates would order them to be transported. Wagon-loads of women in chains were driven to the docks, and there they were herded below decks like cattle, with nothing to do on the voyage. On arrival at the convict settlement they found not a hut to shelter them. Unless they were so fortunate as to find work immediately, they had to live by crime or starve. They were granted a small allowance of food, but they had to trade this for permission to sleep under someone's roof.

The men convicts, more merciful than the Government, and better able to get work than the women, would steal from their employers to help them, and so the circle of crime went on, until one judge said: "There is no regenerating a felon in this life, and for his own sake, as well as for the sake of society, I think it better to hang." Many agreed with him.



Florence Nightingale, the Lady with the Lamp, who taught men how to organize a nursing service.

Faced with so much horror, Elizabeth Fry neither ran back to her country home, nor raved against judge and jailer. She went quietly into Newgate, as people were allowed to do then, and set about trying to lighten its misery by the only means in her power. She tried to reform, not the prisons, but the prisoners. First she touched their hearts by caring for the children who shared the mother's imprisonment. In an empty cell she started a school, and even the most brutal women were grateful to her for the advantage she gave their little ones. Then she set all her friends and relatives sewing to clothe the naked. Her most terrible task was trying to comfort women condemned to die for some trivial crime, often young mothers, who were wild with terror and frantic under the injustice.

In this work she was helped by eleven Quakers and one clergyman's wife, whom she had banded together as an Association for the Improvement of the Female Prisoners in Newgate. It is a clumsy, old-fashioned name, like a stagecoach; but it ought to be as glorious as Trafalgar.

HOW LIFE WAS MADE BETTER FOR THE WRETCHED WOMEN OF NEWGATE

When she had won the women's confidence Mrs. Fry gathered the prisoners together and proposed to find profitable work for them if they would obey certain rules. They were to give up drinking, gambling, quarreling and foul language. They were to be divided into classes of twelve, each class under the control of a monitor chosen from the prisoners. They were to be clean in person and neat in dress. Twice a day they were to assemble to hear the Scriptures read. For her part, she would get contractors to provide them with knitting or sewing, and the profits on their work should go toward buying them food while in prison and giving them a provision for the day of their release. The women eagerly promised to abide by these rules, and suddenly the want, filth, noise and disorder of the women's half of Newgate passed away.

When the authorities saw that she had changed creatures who seemed half animal, half demon, into decent, well-behaved women, they were eager to seek her advice and carry out her wishes. They had made no effort to keep order or to improve the women; their only care had been to prevent them from getting out.

But now it dawned on them that the pandemonium and dirt had been a shame and a cruelty. They made Mrs. Fry's school and factory a part of the prison system. After ten months of her work a committee in the House of Commons sent for her, and the simple Quaker lady, summoning her courage, told them that prisons should be places of reform and not of state revenge.

THE COUNTRY GROWS ASHAMED OF ITS CRUEL PRISON SYSTEM

Elizabeth Fry suggested that the prisoners should be regularly fed, given some occupation, and clothed. Dark cells and solitary confinement, she said, were cruel, but it would be well if the prisoners could sleep alone; then each had from 18 to 24 inches by 6 feet in which to lie on the floor. How difficult it is to believe these things to-day!

A few women, working privately, had reformed the disgusting den called Newgate. The whole country's attention was roused. Ladies everywhere began prison-visiting. Lord Lansdowne made a speech in Parliament about Elizabeth Fry and demanded reform of the prison system. The Chancellor of the Exchequer asked Mrs. Fry to show him Newgate, and Queen Charlotte sent for her. The shy woman dreaded meeting with notabilities, but she forced herself to seize every opportunity to speak for the captives. Much later, in 1842, we find her shrinking from a banquet at the Mansion House, where she was invited to meet Prince Albert, Sir Robert Peel and other ministers. Yet she made herself go that the Prince might learn from her and tell Queen Victoria that the jailers had too much power, that punishments were too severe, and that dark cells were atrociously cruel.

HOW THE GOOD WORK OF A WOMAN SPREAD TO OTHER NATIONS

In 1818 Mrs. Fry had made a tour of the Scottish prisons and was horrified to discover that lunatics were treated as criminals and brutally used there. Later she went abroad on the same errand, everywhere trying to stir up interest in the lot of prisoners, and everywhere honored by the great ones of the earth. She kept up a regular correspondence with those whom she had been able to influence, and because of her advice the prisoner's lot was lightened not only in England, but in France, Denmark, Germany, Russia and Switzerland. In 1842 the king of Prussia came to England and insisted on visiting Mrs. Fry, because she had traveled hundreds of miles to visit his prisoners.

Mrs. Fry was able to lighten the horrors of transportation before that punishment was suppressed. She persuaded the government to build barracks for the women at the convict settlement, so that they might not be roofless and driven to crime. She arranged for them to have profitable sewing to do on the voyage, and got them sent to the docks in hackney coaches instead of open wagons. She struck off their chains.

Once Mrs. Fry saw a batch come on

the top of a coach, the whole eleven chained together, so that they could not get down separately but were all dragged down at once; some of them had children in their arms. One woman from Wales arrived wearing an iron hoop, and when Mrs. Fry got it removed she fainted from the pain. For some time she said, she had worn three hoops, each connected with chains, one round the waist, one round the knees, one round the ankles. At night her hands had been chained to the hoop at her waist.

We cannot tell here of all the merciful works of Elizabeth Fry. She was concerned with associations to help servants, orphans and juvenile offenders, to train nurses for the sick, and to supply books to the coastguards, who in those days were cut off from other men by their regulations almost like lepers.

We must turn to her private affairs. Her husband's great business failed, and the Frys were obliged to leave Plashet House, their dear garden, the old nurseries, the charities and pensioners they had there. Several of their children married outside the Quaker movement, and for this were expelled from the Society of Friends. Through all these troubles Mrs. Fry's letters and journals reflect the unshakable peace and happiness that comes to those whose life is spent in serving others.

The beautiful statue to Florence Nightingale at Derby.

Florence Nightingale as a woman of thirty-four.

In 1842 her delicate health gave way. She struggled on for a few years, but an epidemic carried off nearly all she loved, and toward the end this suffering seemed to blur her reason. At times her clear spirit shone through the mists. She craved to be taken again to a Quaker meeting, and, taken to one in a wheelchair by her husband, she spoke like a prophet of the soul's immortality, and ended with the words of Isaiah: "Thine eyes shall see the king in his beauty; they shall behold the land that is very far off."

She died on October 12, 1845. But the cruel old prison system of England had died before her.

FLORENCE NIGHTINGALE

Florence Nightingale—when will her glory fade? If they were asked who was Florence Nightingale, most children would say that she was a lady who nursed the British soldiers in the Crimean War. But that would be all too inadequate an answer.

Her real work began when the public thought it had ended, at the close of the Crimean War. It is because of the fifty years which followed that she deserves to be remembered as the "Lady with the Lamp"—the Lamp of Knowledge.

Florence Nightingale was born in 1820 in the city from which she got her Christian name. She was an heiress. Her family owned three large houses; they traveled a great deal, and moved in a world of fashionable ladies and cabinet ministers.

But Florence was soon as weary of parties as a grown-up would be of baby food. She wrote that since she was six she had craved to have something to do. "A profession, a trade, something to fill and employ all my faculties. The first thought I can remember, and the last, was nursing work." She was born with a vocation and could not rest.

Unhappily for her, people of that age considered it unwomanly for a girl to think of anything but marriage. Florence Nightingale had many suitors, and seems to have cared for one of them. But she wrote in her journal that if she married him she would have had to continue her society life, and that she could not endure.

When she was twenty-five she dared to make an extraordinary proposal to her scandalized parents: might she go to Salisbury Hospital as a nurse? "It was as if I had wanted to be a kitchen maid," she wrote; and they refused flatly. In those days, remember, nurses were women of a low type, as ignorant of their work as charwomen, notorious for drunkenness, and often thoroughly bad characters. Dickens' picture of that disgusting old woman, Mrs. Gamp, with her grimy clothes and her gin bottle, was a true portrait of the nurse of those days. Florence Nightingale was the first person that ever thought of their calling as a high profession.

FLORENCE NIGHTINGALE SETS OUT WITH HER NOBLE BAND OF NURSES

However, she took up her society life anew, like a heavy burden. Her family did not know that she was always reading medical books and paying secret visits to hospitals and workhouses. Once when they were all abroad she "succeeded in slipping off to a nursing institution at Kaiserswerth," where she worked for three months.

At last, when she was thirty-three, her parents despaired of stamping out her strange craving for work, and she was allowed to become superintendent of a charitable nursing home in Harley Street, London. She had been there for a year when the Crimean War broke out. It soon became known that the nursing base at Scutari was inadequately served, and a letter from Florence Nightingale offering her services crossed one from her friend Sidney Herbert, a cabinet minister, asking for them. In a week's time she sailed for Constantinople at the head of a band of thirty-eight nurses, taking with her large supplies of medical stores, though the War Office had assured her that "nothing was wanted at Scutari."

HOW A WOMAN TURNED DISEASE AND CHAOS INTO HEALTH AND ORDER

She arrived the day before the battle of Inkerman, ten days after Balaclava. She found a hospital built over cesspools. There was no ventilation. The floorboards were rotten. The walls were covered with vermin. There were four miles of beds, packed together, with hardly room to pass down the lines. There were no materials for cleaning, no knives, no forks, no clothing and no medical stores of any kind. Before she arrived at Scutari the total number of shirts washed at the hospital during the campaign had been seven.

Red tape bound everyone hand and foot. Once, when the men were bitterly cold and 27,000 shirts had arrived for them, it was three weeks before the necessary formalities were got through and they could be unpacked. But worst of all was the prejudice and jealousy with which the chief doctors regarded this woman's appointment.

Because she had a will of steel, a genius for organization and a commanding personality, because she brushed aside red tape like a spider's web, Florence Nightingale was able to bring order, comfort, cleanliness and health out of the chaos. The death-rate fell from 42 per cent to 22 per thousand. The soldiers worshiped her. But it is terrible to think that Florence Nightingale was fighting for them against those who should have been working with her. Once a doctor who resented her authority ordered that no rations should be supplied to her, but her foresight outwitted this petty attempt to starve her out.

THE LADY WITH THE LAMP

FLORENCE NIGHTINGALE RECEIVING THE WOUNDED AT THE HOSPITAL

FLORENCE NIGHTINGALE ON HER MISSION OF MERCY

FLORENCE NIGHTINGALE CALLS ON HER FRIEND SIDNEY HERBERT, SECRETARY FOR WAR

These panels are from the Florence Nightingale statue in London, the work of Mr. A. G. Walker

Her devotion to her work brought inspiration and hope to her patients. Many a day she stood for twenty hours while arranging accommodation for the wounded, for she would not rest as long as she felt some poor fellow needed attention. She made it her business to be present in the operating-room to cheer the suffering soldiers. At night, when other attendants in the wards had retired, exhausted, to snatch a few hours' sleep, this indomitable woman would take her lamp and visit every ward. To the thirsty she gave the longed-for drink of water, to the suffering the little attention that meant relief from a great deal of pain, and to the lonely a tender word of comfort.

THE GREAT WORK CARRIED ON FROM AN INVALID'S COUCH

In 1856, when the wretched war was over, Florence Nightingale returned to England a popular idol. But her heart was strained, and she suffered from prolonged fainting fits. The doctors ordered her complete rest, and thought her on the brink of death. That, she told them, was all the more reason why she should make haste with her work. The suffering of Scutari must never be repeated; the Army medical system must be reformed, and she must devote her life, short or long, to that work.

She lived, always an invalid, to the great age of ninety-one. For years her home was a little house in London. She saw no one except on medical business, and though rarely able to walk downstairs, was one of the hardest workers in the land. All day and nearly all night she lay writing, dictating, reading blue books, interviewing officials. A band of loyal helpers formed what was called the Nightingale Cabinet; among them was Sidney Herbert and the poet Arthur Hugh Clough.

THE CROWNING TRIUMPH OF A LIFE DEVOTED TO REFORM

But the whole British War Office was against reform, against anything *new*, good or bad, and it was only after herculean labors that Florence Nightingale forced the authorities to appoint a Royal Commission to report on the health of the British Army. Being a woman, she could not take open part; but she coached the members all through, and their report was founded entirely on matter supplied by her.

Reform was now inevitable. The Army medical authorities were made responsible for keeping the soldiers well, besides curing them when they were sick. Florence Nightingale had pointed out that the mortality in the old barracks was almost twice the mortality in ordinary life. She said: "You might as well take 1,100 men every year out on Salisbury Plain and shoot them." But now dirt and muddle, swept, like two great spiders, from a dark corner, fled from the barracks. Reading and recreation rooms were provided, although the officers had laughed at Florence Nightingale at Scutari for "spoiling the brutes" by providing them with books. The private soldier never had a better friend.

Florence Nightingale's work was not confined to the Army. She opened a Training School for Nurses at St. Thomas's Hospital in London. She was truly "the founder of modern nursing," not merely a nurse, but *the first scientific nurse*. Moreover, she wrote books full of statistics, practical plans and minute details which revolutionized hospital administration. We must think of her not only as the merciful healer of the sick, but as the merciless enemy of ignorant prejudice. Her statue as the Lady of the Lamp stands in Waterloo Place, near that of Sidney Herbert, and not far from that of Captain Scott. Rightly she stands among the heroes.

TWO FIGURES STANDING SUPREME AMONG THE WORLD'S WOMEN

We have come to the end of two important biographies. These two, the supreme women figures of the modern world, did more than any others to change it from the barbarous old world to the world we know; a world which, with all its faults, never doubts that callousness to the suffering of others is a crime.

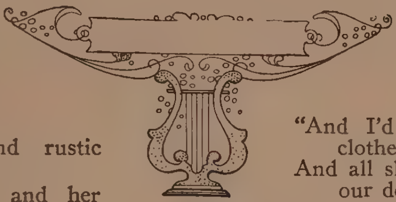
It is well to study the methods by which they brought about their merciful reforms. In Russia those who hated the evils of the old system were like Samson, who pulled down the pillars of the house so that he and his enemies were buried in one great downfall. These two women, judging the foundations of civilization to be sound, set about repairing the structure. Let us look at the result of each method, and choose how we shall set to work when our turn comes to serve humanity.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 5813.

A BALLAD BY A GREAT AMERICAN POET

JOHN GREENLEAF WHITTIER, one of the foremost poets of America, was born on December 17, 1807, and died September 7, 1892. He took a prominent part in the long fight for the liberation of the slaves in our land, and all his writings breathe a steady devotion to the cause of liberty and righteousness. One of his ballads has been chosen here as an example of his sweet and tender poetry. It is a simple story of what is happening every day, and there are many to whom the words "It might have been" have all the sad meaning they had for Maud Muller and the Judge.

MAUD MULLER: A TALE IN VERSE



MAUD MULLER on a summer's day
Raked the meadow sweet with hay.

Beneath her torn hat glowed the wealth
Of simple beauty and rustic health.

Singing, she wrought, and her merry glee
The mock-bird echoed from his tree.

But when she glanced to the far-off town,
White from its hill-slope looking down,

The sweet song died, and a vague unrest
And a nameless longing filled her breast—

A wish that she hardly dared to own
For something better than she had known.

The Judge rode slowly down the lane,
Smoothing his horse's chestnut mane.

He drew his bridle in the shade
Of the apple-trees, to greet the maid,

And asked a draught from the spring that flowed
Through the meadows across the road.

She stooped where the cool spring bubbled up,
And filled for him her small tin cup,

And blushed as she gave it, looking down
On her feet so bare, and her tattered gown.

"Thanks!" said the Judge, "a sweeter draught
From a fairer hand was never quaffed."

He spoke of the grass and flowers and trees,
Of the singing birds and the humming bees;

Then talked of the haying, and wondered whether
The cloud in the west would bring foul weather.

And Maud forgot her briar-torn gown,
Her graceful ankles bare and brown;

And listened, while a pleased surprise
Looked from her long-lashed hazel eyes.

At last, like one who for delay
Seeks a vain excuse, he rode away.

Maud Muller looked and sighed: "Ah me!
That I the Judge's bride might be!

"He would dress me up in silks so fine,
And praise and toast me at his wine.

"My father should wear a broadcloth coat;
My brother should sail a painted boat.

"I'd dress my mother so grand and gay,
And the baby should have a new toy each day.

"And I'd feed the hungry and clothe the poor,
And all should bless me who left our door."

The Judge looked back as he climbed the hill,
And saw Maud Muller standing still.

"A form more fair, a face more sweet,
Ne'er hath it been my lot to meet.

"And her modest answer and graceful air
Show her wise and good as she is fair.

"Would she were mine, and I to-day,
Like her, a harvester of hay;

"No doubtful balance of rights and wrongs,
Nor weary lawyers with endless tongues,

"But low of cattle and song of birds,
And health of quiet and loving words."

But he thought of his sisters, proud and cold,
And his mother, vain of her rank and gold.

So closing his heart, the Judge rode on,
And Maud was left in the field alone.

But the lawyer smiled that afternoon,
When he hummed in court an old love-tune;

And the young girl mused beside the well,
Till the rain on the unraked clover fell.

He wedded a wife of richest dower,
Who lived for fashion, as he for power.

Yet oft, in his marble hearth's bright glow,
He watched a picture come and go;

And sweet Maud Muller's hazel eyes
Looked out in their innocent surprise.

Oft, when the wine in his glass was red,
He longed for the wayside well instead;

And closed his eyes on his garnished rooms,
To dream of meadows and clover blooms.

And the proud man sighed, with a secret pain,
"Ah, that I were free again!

"Free as when I rode that day,
Where the barefoot maiden raked her hay."

She wedded a man unlearned and poor,
And many children played round her door.

But care and sorrow and child-birth pain
Left their traces on heart and brain.

And oft, when the summer sun shone hot
On the new-mown hay in the meadow lot,

And she heard the little spring brook fall
Over the roadside, through the wall,

In the shade of the apple-tree again
She saw a rider draw his rein;

And, gazing down with timid grace,
She felt his pleased eyes read her face.

Sometimes her narrow kitchen walls
Stretched away into stately halls;

The weary wheel to a spinet turned,
The tallow candle an astral burned,

And for him who sat by the chimney lug,
Dozing and grumbling o'er pipe and mug,

A manly form at her side she saw,
And joy was duty, and love was law;

Then she took up her burden of life again,
Saying only, "It might have been!"

Alas! for maiden, alas! for Judge,
For rich repiner and household drudge!

God pity them both, and pity us all,
Who vainly the dreams of youth recall,

For of all sad words of tongue or pen,
The saddest are these: "It might have been!"

Ah, well! for us all some sweet hope lies
Deeply buried from human eyes;

And, in the hereafter, angels may
Roll the stone from its grave away!

RUBIES AND PEARLS

This little poem by Robert Herrick shows us how the so-called "metaphysical" poets of his age overdrew their comparisons.

SOME asked me where the rubies grew,
And nothing I did say,
But with my finger pointed to
The lips of Julia.

Some asked how pearls did grow, and where;
Then spoke I to my girl,
To part her lips, and showed them there
The quarrelets of pearl.

TO ALTHEA FROM PRISON

Colonel Richard Lovelace was one of the most distinguished of the company of courtly poets gathered round Queen Henrietta, the wife of Charles I.

WHEN Love with unconfinèd wings
Hovers within my gates,
And my divine Althea brings
To whisper at the grates;
When I lie tangled in her hair
And fetter'd to her eye,
The birds that wanton in the air
Know no such liberty.

When flowing cups run swiftly round
With no allaying Thames,
Our careless heads with roses crown'd,
Our hearts with loyal flames;
When thirsty grief in wine we steep,
When healths and draughts go free—
Fishes that tipple in the deep
Know no such liberty.

When, linnet-like confinèd I
With shriller throat shall sing
The sweetness, mercy, majesty
And glories of my King;
When I shall voice aloud how good
He is, how great should be,
Enlargèd winds, that curl the flood,
Know no such liberty.

Stone walls do not a prison make,
Nor iron bars a cage;
Minds innocent and quiet take
That for an hermitage;
If I have freedom in my love
And in my soul am free,
Angels alone, that soar above,
Enjoy such liberty.

THE PRIEST AND THE MULBERRY-TREE

Thomas Love Peacock was born October 18, 1785, and died January 23, 1866. He wrote a number of stories full of wit and satire and sprinkled with charming poems.

DID you hear of the curate who mounted his mare,
And merrily trotted along to the fair?
Of creature more tractable none ever heard:
In the height of her speed she would stop at a word;
But again with a word, when the curate said Hey!
She put forth her mettle and gallop'd away.

As near to the gates of the city he rode,
While the sun of September all brilliantly glow'd,
The good priest discover'd, with eyes of desire,
A mulberry-tree in a hedge of wild briar:
On boughs long and lofty, in many a green shoot,
Hung large, black, and glossy, the beautiful fruit.

The curate was hungry and thirsty to boot;
He shrunk from the thorns, though he long'd for the fruit;
With a word he arrested his courser's keen speed,
And he stood up erect on the back of his steed;
On the saddle he stood while the creature stood still,
And he gather'd the fruit till he took his good fill.

"Sure never," he thought, "was a creature so rare,
So docile, so true, as my excellent mare;
Lo, here now I stand," and he gazed all around,
"As safe and as steady as if on the ground;
Yet how had it been, if some traveller this way,
Had, dreaming no mischief, but chanced to cry Hey?"

He stood with his head in the mulberry-tree,
And he spoke out aloud in his fond reverie;
At the sound of the word the good mare made a push
And down went the priest in the wild-briar bush.
He remember'd too late, on his thorny green bed,
Much that well may be thought cannot wisely be said.

WE ARE THE DREAMERS OF DREAMS

In these stirring lines by Arthur O'Shaughnessy, a master of lyrical prose, we feel the passionate love of the poet for his dreaming. Arthur O'Shaughnessy was born in 1844 and died in 1881. From this poem we may learn that he held the very highest opinion of the poet's mission and influence.

WE are the music-makers,
  And we are the dreamers of dreams,
Wandering by lone sea-breakers,
  And sitting by desolate streams;
World-losers and world-forsakers
  On whom the pale moon gleams:
Yet we are the movers and shakers
  Of the world for ever, it seems.

With wonderful deathless ditties
We build up the world's great cities,
And out of a fabulous story
We fashion an empire's glory:
One man with a dream at pleasure
  Shall go forth and conquer a crown;
And three with a new song's measure
  Can trample an empire down.

We, in the ages lying
  In the buried past of the earth,
Built Nineveh with our sighing,
  And Babel itself with our mirth;
And overthrew them with prophesying
  To the old of the new world's worth:
For each age is a dream that is dying,
  Or one that is coming to birth.

A breath of our inspiration
Is the life of each generation—
A wondrous thing of our dreaming,
Unearthly, impossible seeming.
The soldier, the king, and the peasant
  Are working together in one,
Till our dreams shall become their present
  And their work in the world be done.

They had no vision amazing
Of the goodly house they are raising;
They had no divine foreshowing
Of the land to which they are going;
But on one man's soul it hath broken,
  A light that doth not depart,
And his look, or a word he hath spoken,
  Wrought flame in another man's heart.

And therefore to-day is thrilling
With a past day's late fulfilling,
And the multitudes are enlisted
In the faith that their fathers resisted;
And, scorning the dream of to-morrow,
  Are bringing to pass, as they may,
In the world, for its joys or its sorrow,
  The dream that was scorned yesterday.

But we, with our dreaming and singing,
  Ceaseless and sorrowless we,
The glory about us clinging
  Of the glorious futures we see,
Our souls with high music ringing:
  O men! it must ever be
That we dwell, in our dreaming and singing,
  A little apart from ye.

For we are afar with the dawning
  And the suns that are not yet high,
And out of the infinite morning
  Intrepid you hear us cry,
How, spite of your human scorning,
  Once more God's future draws nigh,
And again goes forth the warning
  That ye of the past must die.

"Great hail!" we cry to the comers
  From the dazzling unknown shore;
"Bring us hither your sun and your summers,
  And renew our world as of yore.
You shall teach us your song's new numbers,
  And things that we dreamed not before;
Yea, in spite of a dreamer who slumbers,
  And a singer who sings no more."

THE ISLE OF LONG AGO

Benjamin Franklin Taylor was one of the lesser-known American poets. He lived from 1819 to 1887, and wrote many pleasant verses and much good prose.

O! a wonderful stream is the River Time,
  As it runs through the realm of Tears,
With a faultless rhythm and a musical rhyme,
And a broader sweep and a surge sublime,
  As it blends with the Ocean of Years.

How the winters are drifting, like flakes of snow,
  And the summers, like buds between,
And the year in the sheaf—so they come and they go,
On the river's breast, with its ebb and its flow,
  As it glides in the shadow and sheen.

There's a magical isle up the River Time,
  Where the softest of airs are playing;
There's a cloudless sky and a tropical clime,
And a song as sweet as a vesper chime,
  And the Junes with the roses are straying.

And the name of the isle is the Long Ago,
  And we bury our treasure there;
There are brows of beauty, and bosoms of snow;
There are heaps of dust—but we loved them so!
  There are trinkets, and tresses of hair.

There are fragments of song that nobody sings,
  And a part of an infant's prayer;
There's a lute unswept, and a harp without strings;
There are broken vows, and pieces of rings,
  And the garments that She used to wear;

There are hands that are waved, when the fairy shore
  By the mirage is lifted in air;
And we sometimes hear, through the turbulent roar,
Sweet voices we heard in the days gone before,
  When the wind down the river is fair.

O! remembered for aye be the blessed isle,
  All the day of our life till night;
When the evening comes with its beautiful smile,
And our eyes are closing to slumber awhile,
  May that "Greenwood" of Soul be in sight!

THE SONG OF THE SHIRT

Thomas Hood, one of the most lovable of English poets, was equally great in comic and serious verse. The poem that is given here is one that will never be forgotten. Only a powerful poet whose heart had bled for the poor and oppressed could have written its moving and burning lines. It is well to remember in reading them that their author could make us laugh as few other poets have ever done, and that it is usually those who see the comic side of life that can best understand and express its serious and tender side.

WITH fingers weary and worn,
With eyelids heavy and red,
A woman sat, in unwomanly rags,
Plying her needle and thread—
Stitch—stitch—stitch!
In poverty, hunger, and dirt,
And still with a voice of dolorous pitch
She sang the "Song of the Shirt!"

"Work—work—work!
While the cock is crowing aloof;
And work—work—work
Till the stars shine through the roof!
It's oh! to be a slave
Along with the barbarous Turk,
Where woman has never a soul to save,
If this is Christian work!

"Work—work—work!
Till the brain begins to swim;
Work—work—work
Till the eyes are heavy and dim!
Seam, and gusset, and band—
Band, and gusset, and seam—
Till over the buttons I fall asleep
And sew them on in a dream!

"Oh, men with sisters dear!
Oh, men with mothers and wives!
It is not linen you're wearing out,
But human creatures' lives!
Stitch—stitch—stitch,
In poverty, hunger, and dirt,
Sewing at once with a double thread
A shroud as well as a shirt.

"But why do I talk of Death?
That phantom of grisly bone,
I hardly fear his terrible shape,
It seems so like my own—
It seems so like my own,
Because of the fasts I keep;
O God! that bread should be so dear,
And flesh and blood so cheap!

"Work—work—work!
My labour never flags;
And what are its wages? A bed of straw,
A crust of bread—and rags.
That shattered roof, and this naked floor,
A table, a broken chair!
And a wall so blank, my shadow I thank
For sometimes falling there.

"Work—work—work!
From weary chime to chime,
Work—work—work
As prisoners work for crime!
Band, and gusset, and seam—
Seam, and gusset, and band—
Till the heart is sick, and the brain benumbed,
As well as the weary hand.

"Work—work—work!
In the dull December light,
And work—work—work
When the weather is warm and bright;
While underneath the eaves
The brooding swallows cling,
As if to show me their sunny backs,
And twit me with the spring.

"Oh! but to breathe the breath
Of the cowslip and primrose sweet—
With the sky above my head,
And the grass beneath my feet!
For only one short hour
To feel as I used to feel,
Before I knew the woes of want
And the walk that costs a meal!

"Oh, but for one short hour!
A respite however brief!
No blessèd leisure for love or hope,
But only time for grief!
A little weeping would ease my heart;
But in their briny bed
My tears must stop, for every drop
Hinders needle and thread!"

With fingers weary and worn,
With eyelids heavy and red,
A woman sat, in unwomanly rags,
Plying her needle and thread—
Stitch—stitch—stitch!
In poverty, hunger, and dirt,
And still with a voice of dolorous pitch—
Would that its tone could reach the rich!—
She sang this "Song of the Shirt!"

THE ANGELS' WHISPER

Samuel Lover was born in Dublin, February 24, 1797, and died July 6, 1868. He was a celebrated Irishman who did many things well. He began life as an artist, wrote two famous novels, some plays, many charming songs, and was a successful entertainer. This is one of his best-known songs, and even young readers will at once recognize the melody of its verse and the tender feeling it so beautifully expresses.

A BABY was sleeping,
Its mother was weeping,
For her husband was far on the wild raging sea;
And the tempest was swelling
Round the fisherman's dwelling,
And she cried: "Dermot, darling, oh, come back to me!"

Her beads while she numbered
The baby still slumbered
And smiled in her face as she bended her knee.
"Oh, blessed be that warning,
My child, thy sleep adorning,
For I know that the angels are whispering with thee.

"And while they are keeping
Bright watch o'er thy sleeping,
Oh, pray to them softly, my baby, with me,
And say thou wouldst rather
They'd watch o'er thy father,
For I know that the angels are whispering with thee."

The dawn of the morning
Saw Dermot returning,
And the wife wept with joy her babe's father to see,
And closely caressing
Her child, with a blessing,
Said: "I knew that the angels were whispering with thee."

THE WIND AND THE MOON

Dr. George Macdonald, to whose rich fancy we owe this charming poem, wrote many fine novels. We could almost guess from reading the following that he could write a pretty fairy tale, and he did write many really delightful stories of fairyland. He was a remarkable preacher, and altogether a man of very original mind. Born at Huntly, Aberdeenshire, in 1824, he died in Italy on September 18, 1905.

SAID the Wind to the Moon, "I will blow you out!
You stare
In the air
As if crying 'Beware!'
Always looking what I am about.
I hate to be watched! I will blow you out!"

The Wind blew hard, and out went the Moon.
So, deep
On a heap
Of clouds, to sleep
Down lay the Wind, and slumbered soon,
Muttering low, "I've done for that Moon!"

He turned in his bed: she was there again!
On high
In the sky,
With her one ghost-eye,
The Moon shone white and alive and plain.
Said the Wind, "I will blow you out again!"

The Wind blew hard, and the Moon grew slim.
"With my sledge
And my wedge
I have knocked off her edge!
I will blow," said the Wind, "right fierce and grim,
And the creature will soon be slimmer than slim!"

He blew and he blew, and she thinned to a thread.
"One puff
More's enough
To blow her to snuff!
One good puff more where the last was bred,
And glimmer, glimmer, glum will go that thread!"

He blew a great blast, and the thread was gone.
In the air
Nowhere
Was a moonbeam bare:
Larger and nearer the shy stars shone:
Sure and certain the Moon was gone!

The Wind he took to his revels once more;
On down
And in town,
A merry, mad clown,
He leaped and halloed with whistle and roar—
When there was a glimmering thread once more!

He flew in a rage—he danced and blew;
But in vain
Was the pain
Of his bursting brain,
For still the Moon-scrap the broader grew
The more that he swelled his big cheek and blew.

Slowly she grew—till she filled the night,
And shone
On her throne
In the sky alone,
A matchless, wonderful, silvery light,
Radiant and lovely, the queen of the night.

Said the Wind, "What a marvel of power am I!
With my breath,
In good faith,
I blew her to death!
First blew her away right out of the sky,
Then blew her in: what a strength am I!"

But the Moon she knew naught of the silly affair;
For high
In the sky,
With her one white eye,
Motionless miles above the air,
She never had heard the Wind blare.

THE BEST SCHOOL OF ALL

There is, of course, but one "best school," and that is the one at which each of us has been a scholar. Our own old school, no matter what others may think of theirs, is to us "the best school of all." Henry Newbolt, one of the finest living poets, in these ringing and vigorous verses celebrates with the true touch of boyish patriotism the memory of all our schooldays. One would be sorry for the "old boy" who could not sing this fine song and feel it to be true, for he would have missed one of the real pleasures of life. It is here reprinted by special permission of Newbolt.

IT'S good to see the school we knew,
The land of youth and dream,
To greet again the rule we knew
Before we took the stream:
Though long we've missed the sight of her,
Our hearts may not forget;
We've lost the old delight of her,
We keep her honour yet.

We'll honour yet the school we knew,
The best school of all:
We'll honour yet the rule we knew,
Till the last bell call.
For, working days or holidays,
And glad or melancholy days,
They were great days and jolly days
At the best school of all.

The stars and sounding vanities
That half the crowd bewitch,
What are they but inanities
To him that treads the pitch?
And where's the wealth, I'm wondering,
Could buy the cheers that roll,
When the last charge goes thundering
Beneath the twilight goal?

The man that tanned the hide of us,
Our daily foes and friends,
They shall not lose their pride of us
Howe'er the journey ends.
Their voice, to us who sing of it,
No more its message bears,
But the round world shall ring of it
And all we are be theirs.

To speak of Fame a venture is,
There's little here can bide,
But we may face the centuries,
And dare the deepening tide:
For though the dust that's part of us
To dust again be gone,
Yet here shall beat the heart of us—
The school we handed on!

We'll honour yet the school we knew,
The best school of all:
We'll honour yet the rule we knew,
Till the last bell call.
For, working days or holidays,
And glad or melancholy days,
They were great days and jolly days
At the best school of all.

LITTLE VERSES FOR VERY LITTLE PEOPLE

A LITTLE old man and I fell out;
How shall we bring this matter about?
Bring it about as well as you can;
Get you gone, you little old man.

THERE'S a neat little clock,
In the schoolroom it stands,
And it points to the time
With its two little hands.
And may we, like the clock,
Keep a face clean and bright,
With hands ever ready
To do what is right.

AS I was going up Pippin Hill,
Pippin Hill was dirty;
There I met a pretty miss,
And she dropped me a curtsey.

Little miss, pretty miss,
Blessings light upon you!
If I had half a crown a day,
I'd spend it all upon you.

THEY that wash on Friday, wash in need;
And they that wash on Saturday, oh! they're sluts indeed.

Words by Alfred P. Graves.

M. N. O.

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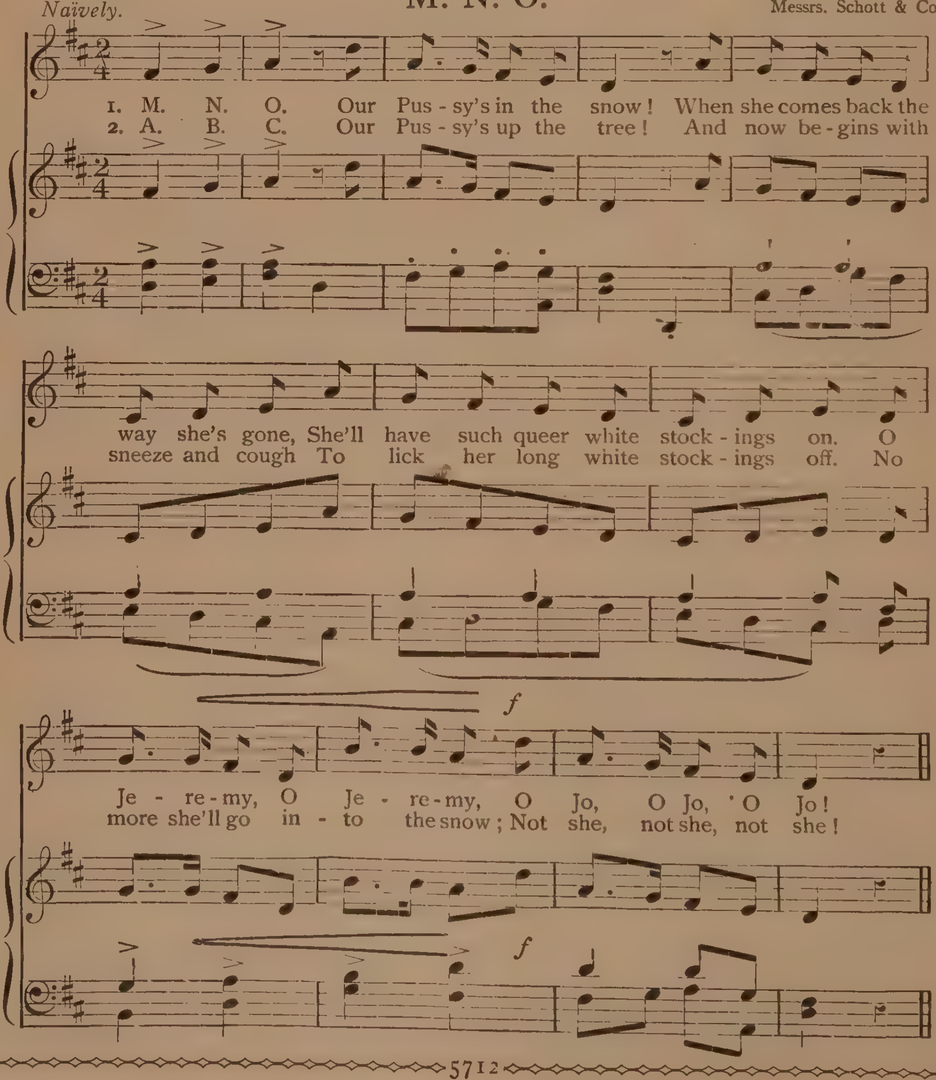
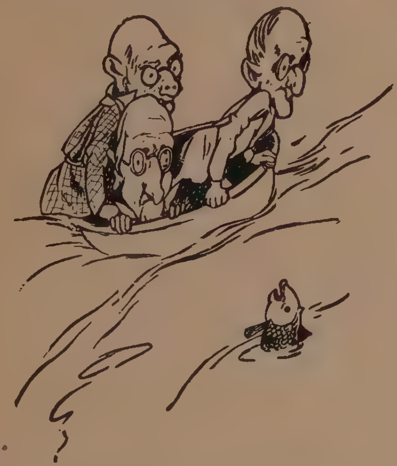

Naïvely.
1. M. N. O. Our Pus-sy's in the snow! When she comes back the way she's gone, She'll have such queer white stock-ings on. O Je-re-my, O Je-re-my, O Jo, O Jo, O Jo!
2. A. B. C. Our Pus-sy's up the tree! And now be-gins with sneeze and cough To lick her long white stock-ings off. No more she'll go in-to the snow; Not she, not she, not she!
f

I HAD a little pony,
His name was Dapple Gray,
I sent him to a lady,
To ride a mile away.

She whipped him, she slashed him,
She rode him through the mire;
I would not lend my pony now
For all that lady's hire.

POOR old Robinson Crusoe!
Poor old Robinson Crusoe!
They made him a coat
Of an old nanny goat,
I wonder how they could do so!
With a ring a ting tang,
And a ring a ting tang,
Poor old Robinson Crusoe!

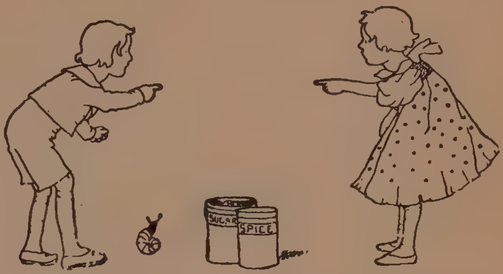


THREE wise men of Gotham
Went to sea in a bowl:
And if the bowl had been stronger
My song would have been longer.

I'LL tell you a story,
About Jack a Nory—
And now my story's begun:
I'll tell you another
About Jack and his brother—
And now my story's done.

PUSSY-CAT MOLE
Jumped over a coal,
And in her best petticoat burnt a great hole.
Poor Pussy's weeping—she'll have no more milk
Until her best petticoat's mended with silk.

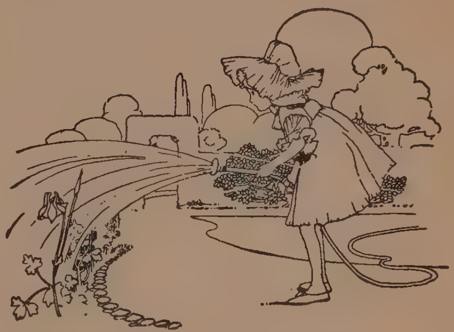
WHAT are little boys made of, made of,
What are little boys made of?
Snaps and snails, and puppy-dogs' tails;
And that's what little boys are made of, made of.



What are little girls made of, made of,
What are little girls made of?
Sugar and spice, and all that's nice;
And that's what little girls are made of, made of.

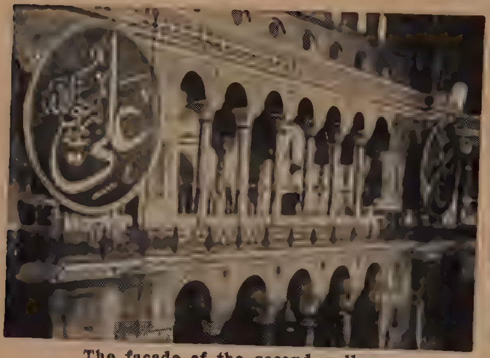
THERE was an old woman, and what do you think?
She lived upon nothing but victuals and drink:
Victuals and drink were the chief of her diet;
This tiresome old woman could never be quiet.

She went to the baker to buy her some bread,
And when she came home her old husband was dead;
She went to the clerk to toll the bell,
And when she came back her old husband was well.

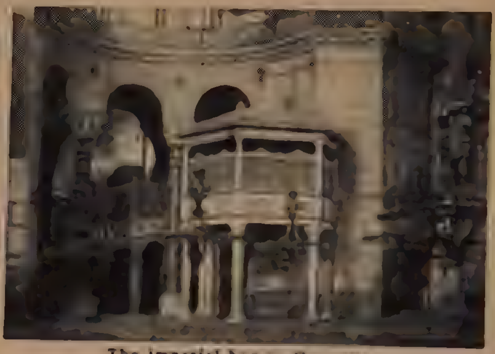


MARY, Mary, quite contrary,
How does your garden grow?
With cockle-shells and silver bells
And columbines all in a row.

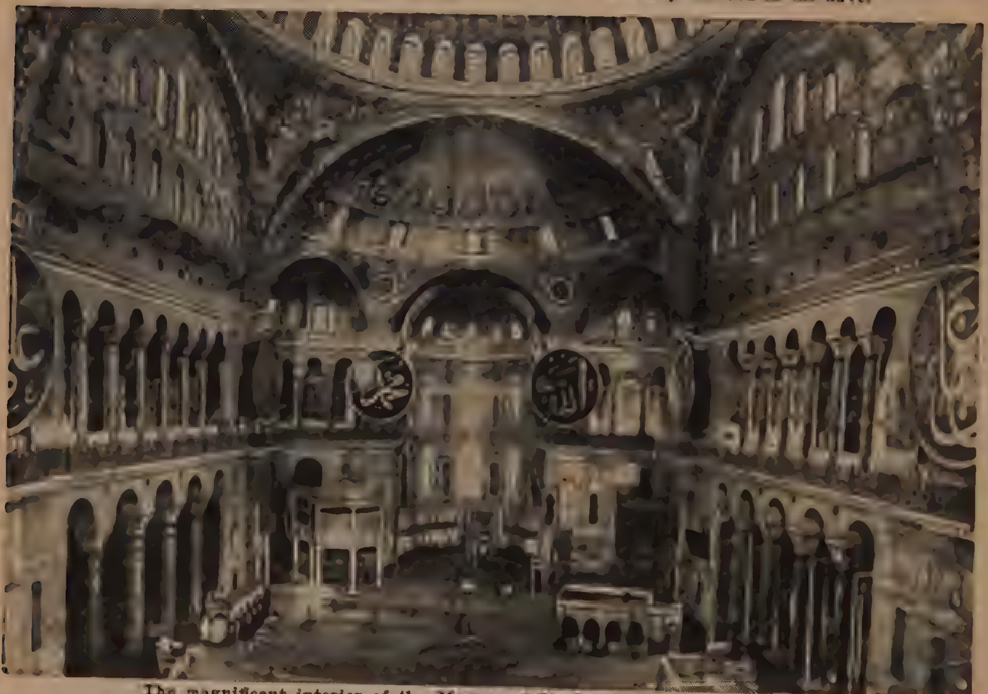
THE SPLENDID MOSQUE OF ST. SOPHIA



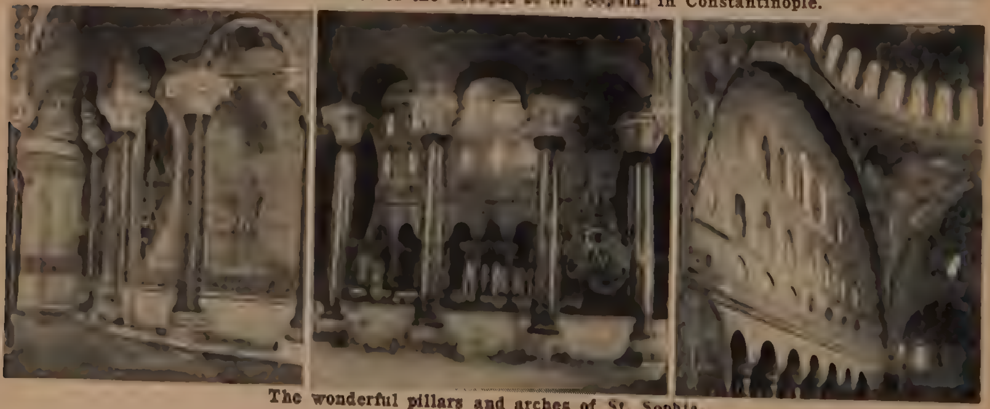
The façade of the second gallery.



The imperial box in the nave.



The magnificent interior of the Mosque of St. Sophia, in Constantinople.



The wonderful pillars and arches of St. Sophia.

The apse of St. Madeleine at Vézelay.

The basilica of St. Irene at Constantinople.

ARCHITECTURE IN CHRISTIAN TIMES

THE THREE EARLIEST STYLES

WHEN we speak of Christian architecture we really mean all the work of the Christian Era, which may be said to date from the year the Cross triumphed in Rome. But it has been found necessary to make other classifications. We describe architecture as Romanesque, Gothic, Renaissance, Modern, and keep the term Early Christian for the work of some five hundred years in Europe—from the time of Constantine, who early in the fourth century made Christianity the religion of the Empire, to the days of Charlemagne.

When the Christians in Rome found themselves in favor after the bitter years of persecution and were told they might have churches of their own instead of hiding in the catacombs, they were somewhat at a loss as to where to start and what to do. They were poor and not very numerous, and Roman by birth. It was both natural and wiser for them to continue the Roman tradition. They built their first churches on the model of the basilicas, which we spoke of on page 5348. They used any material that came handy. Like the Saracen mosques, these churches were meeting-houses only. There was no necessity to build a central shrine for the figure of the god, as in the case of pagan temples. Thus this Early Christian architecture is of the simplest kind. Its interest is religious and historic rather than artistic. It was the cradle of a spiritual power that has no equal in history.

The basilican churches followed one general plan. They were long, rather low buildings, with flat timber roofs supported by rows of columns. Sometimes there were three aisles, sometimes five. Men sat on one side the central aisle and women on the other. This aisle was wider and rose higher than the others, and in the clear stretch of wall were set window spaces, generally filled in with blocks of pierced marble.

At the end of the centre aisle stood what was known as the arch of triumph, leading from the rectangular body of the church to its rounded-out end, or apse. There was generally a dome roof to the apse, studded with mosaics and shining glass. The high altar, under a canopy supported by marble columns, stood in the space called the sanctuary, between the arch of triumph and the apse.

Some of the basilicas must have presented a curious aspect when examined in detail, as the beautiful marble columns were taken from discarded pagan temples or baths, cut down to the right length, and strung together in aisles, regardless of varying moldings and carvings. But the general effect was of dignity, and the long vista of the central aisle gave an impression of length—an impression that was partly due to the unbroken lines of columns and partly due to the lowness of the roof.

CHURCHES WERE SET UP FAR AND WIDE AS CHRISTIANITY SPREAD

A good number of basilican churches were set up in Italy as Christianity grew in power. In Rome there were thirty-one; several in Ravenna; they rose in Constantinople, Jerusalem, Bethlehem; in Asia Minor, Egypt, Africa. The largest is St. Paul-outside-the-Walls, Rome, built in the fourth century and reconstructed after the fire that almost destroyed it in 1823. Other well-known Roman basilican churches are St. Clemente, St. Maria Maggiore, St. Agnes-outside-the-Walls. The most famous of the basilican churches are the two dedicated to St. Apollinare, in Ravenna; their wall mosaics are among the most beautiful in the world.

The early Christian architects had a great love for mosaics. Their predecessors, the Romans, had formerly used them for floor decoration only. In the basilican churches the Christians ornamented the walls wherever possible, and the apse domes shone down in a glory of blue and gold glass and lovely colors, full of light. The mosaics of the Ravenna churches were probably worked under Byzantine influence, of which we shall presently be thinking. In this city the Byzantine element became very powerful.

In the history of architecture two developments date from this period: the bell-tower, or campanile, and the baptistery. From the Early Christian campanile grew the church towers of medieval Europe.

THE OLD PAGAN BUILDINGS USED BY THE CHRISTIANS FOR THEIR SERVICES

There was generally a baptistery—a separate building—attached to the principal church of a city, and at this time it was used only for the purposes of the rite of baptism. The baptistery was generally either circular or octagonal. It was built like the smaller Roman temples and tombs. A number of pagan buildings were taken over by the Early Christians for the purpose, and this is one of the most interesting cases of grafting the new on the old that the tale of architecture supplies. It was necessary that the baptistery should be large, as not only had it to serve for several churches, but the rite was administered only three times a year.

Very few baptisteries were built later than the eleventh century, and before that it became usual to place the baptismal font in the vestibule of the church. The three most important of the early days were at Rome, Nocera and Ravenna.

The architecture called Byzantine is really of the Early Christian period and was built for Christian worshipers, but it is of a very different character indeed from the basilican churches of Western Christendom. It dates from the time when Byzantium became the capital of the Roman Empire under the name of Constantinople.

Byzantium, standing on the border-line between Europe and Asia, was already an old city, long peopled by Greeks, when the Roman emperor Constantine made it the seat of his government. Upon the old town rose another that was the New Rome in more senses than one. It was against the instinct of any Roman emperor to take over a town and not impose on it at once something of Roman order, form and grandeur.

THE WONDERFUL NEW ROME THAT AROSE IN THE EAST

The New Rome, as Constantinople was also called, was swept and garnished; aqueducts and great pillared water cisterns built; magnificent buildings set up to house the emperor and his household and his army. Forums were laid out, six, one after the other, with a street that was the main artery of the town running through them. The most wonderful was naturally the Forum of Constantine. Thus was the old town, with its sloth, its decay, its vice, transformed into a Roman imperial city, the centre of a great commercial life, the pivot of a huge empire.

We remember from our chapter on Roman architecture that the forum was the heart of the town's life. This was true of the New Rome as of the old. But in New Rome there were changes. The Hippodrome, where chariot races were held, took the place of the Colosseum of Old Rome, with its gladiatorial fights, and Christian churches took the place of the pagan temples.

The earliest churches were of the basilican type, like those in Rome. The oldest that now exists of the many erected in Constantine's day and after is St. John of the Studium. But the basilican churches of Western Christendom had been built by the Romans, with plenty of fine discarded temples and baths to serve as quarries. In Constantinople, to begin with, the material at hand was poor—brick and concrete were all that could be relied on; marble and granite had to be imported. And the workmen and craftsmen were Greek. The spirit of old Byzantium, although its name was changed and Roman soldiers trod its streets, was nevertheless alive. Moreover, the East was always tapping at the door, so to speak. These two influences, Greek and Asiatic, presently became powerful.

HOW BYZANTINE ARCHITECTURE SLOWLY DEVELOPED FROM THE ROMAN

The change was gradual. It was not as if one day, or one year, a pure basilican church was set up, and the next a pure Byzantine. A little more of a feeling for many-domed roofs covering buildings on a square plan, a little less for rectangular aisles and flat roofs, a little more gorgeousness and a little less severity, and the transformation was complete. Two hundred years after Constantine built his first church, St. Sophia, often called the glory of early Christendom, arose.

This famous building, which has been a Turkish mosque since 1453, is the finest thing Byzantine architecture produced. St. Sophia marks the point of perfection which an art once may reach but never recapture. It stands isolated, unique, in the history of the world.

Byzantine architecture has never died out; it is the natural expression of the Greek branch of the Christian Church which is strongest in Russia and Eastern Europe. There are fine Byzantine churches in Kiev, Moscow, Leningrad; some in Serbia and Greece; several in southern Italy, a good number in Asia Minor. From time to time churches are still built in the Byzantine manner: the Roman Catholic Cathedral, Westminster, is a modern example. During the last generation a number of Byzantine buildings have risen in America. But in no instance has the lofty beauty of St. Sophia been even distantly rivaled.

THE GLORIOUS DOMED ROOF OF THE MOSQUE OF ST. SOPHIA

Greek architecture carried to perfection the principle of the square (trabeated) openings and pillar-supported roofs; Gothic architecture, as we shall presently see, developed to the highest genius the principle of the vaulted roof; in St. Sophia is the finest example of the domed roof, which was the chief glory of Byzantine architecture.

The emperor Justinian caused St. Sophia to be built toward the middle of the sixth century. Its architects were Anthemius of Tralles and Isodorus of Miletus, both Asiatic Greeks. The church is square in plan. Over its central space rises the great dome, 107 feet in diameter, and against its sides, so to speak, each leaning against each other and keeping each other up, are the half domes and quarter domes that roof in the rest of the huge building.

Inside, the general effect is of one enormous rounded shape that hangs over and cups in the mass of the interior which appears like one great oval nave. The effect of this unique doming is one of extraordinary lightness and ease. The eye runs along its lines and back, and is not arrested by ugly supporting masses. An ancient writer described the Church of St. Sophia as being crowned by a canopy that rested in its place of its own accord, as if suspended by a chain from the skies.

Part of the great charm of contour that marks the interior of St. Sophia is due to the good judgment of its architects, who knew that a dome rising too high, so that the eye is wearied in following its lines, is false to the principle of beauty in dome construction. They therefore kept the dome shallow and covered it with gold inset with mosaic pictures of apostles and saints.

THE BRILLIANT LIGHT THAT COMES THROUGH FORTY WINDOWS

Round the lower part of the great dome are forty small windows, twelve on the walls and others in the subsidiary domes, and through these openings the brilliant light of the East creeps in and sheds a white radiance over the heavy richness of the interior. The walls and piers are lined with sheets of marble—white, green, blue and black. Long rows of stately columns of many-colored marble support the galleries that run round the church. Pattern mosaics cover the floor.

The Turks, transforming the Christian church into a Mohammedan mosque, covered up or plastered over many of the mosaic pictures, in some cases hiding them under texts from the Koran. In the lovely apse, where the figure of Christ, brilliantly inset in mosaics, once gleamed from the roof, they set their Mihrab, the niche that points to Mecca.

The Mohammedan invaders added also the four minarets that close in the outer buildings of St. Sophia, plastered over and washed the brickwork of the church in the horizontal bands of color they so much liked, and destroyed the pillared entrance court leading to the arcaded porch of the church. Thus, from the outward appearance of St. Sophia to-day one would not guess the perfect beauty within.

In actual technique of construction this famous church may be taken as an example of all Byzantine architecture. Each building was made of bricks and cement overlaid inside with marble and picture mosaic; in each the beautiful domed roof is the chief feature.

The earlier Byzantine architecture was generally more interesting in the interior than the exterior. The domes were built so as to be beautiful to the worshipers in the church. They were not too high. The result was that, seen from the outside, walls and roofs had a curiously compressed look, as if something had been flattened down. This is all the more evident to a European accustomed to the tall spire and towers of Gothic architecture. To an Eastern, bred in countries where buildings are flat-roofed, with long, blind walls pierced by small windows set high above the ground, this closed-in appearance seems natural.

THE BYZANTINE BUILDINGS WHICH INSPIRED ST. MARK'S AT VENICE

There were many other Byzantine churches in Constantinople; some have been converted to mosques, some destroyed by time and enemy hands. St. Irene is a beautiful church; another, called St. Saviour of the Chora, is known as the Mosaic Mosque because of the exceeding richness of its interior. It also has an interest in that its façade was copied when the Church of St. Mark was built in Venice. The real model of St. Mark's was a very fine Byzantine building called the Church of St. Saviour, in Constantinople, and the plan of this church was also copied when St. Front was built at Périgueux.

St. Mark's, Venice, is one of the most famous churches of medieval Europe. It was built about the eleventh century on the site of a basilican church whose rectangular plan was changed, in the new building, for that of a Greek cross. The church has five domes, the chief one over the centre of the building and one on each arm of the cross. The mosaics of the interior are very wonderful. So cunningly is the church built, wall and pier sliding into dome, that the mosaics seem to run in unbroken contour around its walls. It would seem that the builders had thought much less of the fabric of the church than of this gorgeous display.

The exterior, with its five portals facing the piazza of St. Mark, is one lovely mass of architecture and ornament of varying periods, of shining marble, alabaster, mosaic and gold bands. Many countries and generations gave of their treasures to St. Mark's, and the soft light of the sky and the sea's reflected radiance add a peculiar beauty of their own.

THE PRIDE OF THE VENETIAN PEOPLE IN THEIR BEAUTIFUL CITY

Venice, a powerful republic in her great years, was in a position to take what she wanted, practically speaking, from anywhere. Her traders went near and far, east and west. The pride of the Venetians in their city was unbounded; no wealth was too great to spend on it. They were also an extremely independent people, and though they borrowed the plan of St. Mark's from a pure Byzantine church, they refused to be bound by any laws of established taste. And here we ourselves can learn a lesson of judgment.

We have spoken of the logic and perfect taste of the Greeks. They developed a style of architecture and kept within the bounds imposed by the style. Thus they produced that master-work the Parthenon. The Byzantine architects developed another style and kept, with equal logic and taste, within its limits. Thus they produced that other master-work St. Sophia's. The creators of these marvelous temples knew that in a great edifice one cannot play tricks. If a style is chosen it must be adhered to, and not a single inharmonious line added to the design.

MATERIAL FROM THREE CONTINENTS FOR THE MAKING OF ST. MARK'S

When the people of Venice built St. Mark's it was suggested to them that, having begun on a pure Byzantine model, the church should be so finished. But this seemed to the proud republicans to savor of a loss of liberty. They were not going to be dictated to by anyone: they would build their church as they wished. The ships of Venice swept the eastern seas and brought back from Alexandria and Asia Minor great columns of porphyry and alabaster, blocks of marble for facing. The bronze horses from Nero's arch in Rome came to decorate the front of St. Mark's. Presently "bonnets" were put on the domes. When the Gothic spirit invaded Italy, arches, pinnacles and niches were added to the pile. The result is that St. Mark's has a whimsical and alluring loveliness of its own, but can never rank among the great.

In spite of its beauty, there has always been something too luxurious and unnatural in Byzantine architecture. The gorgeousness of the mosaic-lined interiors may have stifled its life. Figures made of small cubes must needs be a convention, and in too many conventions art cannot live. In any case, the pure Byzantine style is most suited to brilliant climates where large windows are unnecessary.

While this architecture was forming itself in the East, certain changes were taking place in Western Europe, where the Christian Church was growing in power and the empire of Rome crumbling. The dawn of a new day of letters and art was ushered in by the founding of the monastic orders. These presently became very powerful bodies, every generation or so needing new monasteries and churches. All that there was of learning and art in medieval Europe was implanted there by the monks. They were not only the schoolmasters of the continent, they were its architects. It was not until the twelfth century that any secular art or architecture arose.

THE STAMP OF OLD ROME ON THE FACE OF EUROPE

Rome had left her unmistakable stamp on all the European towns she had conquered, and though the empire was gone, her work remained—monuments, bridges, buildings; for many centuries her roads were the chief highways of Europe. And although Eastern influences, through traders and travelers, took root here and there, the finest thing in Europe was the handiwork of old Rome. So that when the new faith, ever increasing, groped for an expression in architecture that would improve on the primitive basilican churches, it still seemed best to cling to the ideas of Rome.

Basilican churches had been at their best a makeshift. They were unsatisfactory chiefly on account of their timber roofs, which so easily exposed the whole building to danger of fire. In discarding them architects were faced by a new difficulty. If they made flat stone roofs instead of wooden ones it meant the conveyance of very large blocks of stone or marble for the purpose; and this they could see might be done once or twice, but in general practice would kill all architecture except in districts that were rich in material.

These early builders found the solution of their difficulties in the simple vaulted roof carried by round arches, which could be made of small stones almost anywhere. As this style of roofing developed, the square-headed doorway and window was discarded for the round-headed opening. This feature, the round arch, formed the prevailing characteristic of the new architecture, which presently became known as Romanesque. The influence of the old pagan style soon waned and died. Rome and Greece were forgotten; became ghosts that lay very still for several centuries.

THE ROMANESQUE CHURCHES BUILT ON THE PLAN OF A CROSS

Romanesque architecture grew in France, Italy, Germany; it came to England by way of the Norman Conquest, and is generally known there as Norman.

The plan of the Romanesque church was a development of the basilican, which was a rectangle with the apse thrust out at the eastern end. An arch of triumph, we remember, had divided the sanctuary, or the place where the altar stood, from the body of the building. In the Romanesque plan the sanctuary was lengthened into the chancel, or choir, and was divided from the rest of the church by a screen. In front of the chancel screen, on each side of the central aisle, or nave, about two-thirds down the length of the church, short arms were thrown out, making transepts. The plan thus became that of a long (Latin) cross, and we can see, in its development from the plan of the basilican church, the first of the changes that led to the more complicated plan of the Gothic church.

As the shape of the building altered in this way, the first of the spires and towers that are such features of our sacred architecture appeared—a development, we remember, from the campanile, or bell-tower. They were thrown up from the body of the church either at the east or west end, or above the place where the transepts crossed the nave.

The many-apsed church appeared as Romanesque architecture developed. Instead of the centre aisle being thrust out to form the apse, and the side aisles ending at a square wall, each aisle had its apse, and the transepts on the eastern face were rounded out too. The French developed the apse to an extraordinary extent. They had a strong feeling for the thrust-out shapes, or bays, from the eastward end of the church, and presently conceived the idea of throwing out a number of bays, like little apses on the chief apse itself, so that in plan it looks like half an enormous rosette. This kind of treatment of the eastern end of a church was called "chevet," and it continued long after Gothic supplanted Romanesque. The only complete chevet in England is formed by the little chapels that radiate from the apse of Westminster Abbey. A good example in New York is to be found in the new Cathedral of St. John the Divine. Here there are seven chapels radiating from the choir.

In some churches an aisle was run round the eastern end, between the chancel inclosure and the apse wall, and was called the ambulatory, where men could walk about and meditate. We can see this feature in many English cathedrals and churches to-day. One, belonging to the Romanesque period, is that of St. Bartholomew, Smithfield.

This kind of arcaded walk brings us to the subject of cloisters—open spaces set with pillars of varied beauty, and cloistered buildings generally.

The great builders of Europe, as we have said, were the monks. The monasteries and abbeys were the centres of interest and power in whatever province and country they arose, and some of their buildings were of very great dignity. We have produced more graceful, light and beautiful buildings, but nothing so imposing as the medieval monasteries.

The honors of architecture are generally accorded to the monks of the Cluniac Order, founded in 909. This great community of scholars and artists were among the first benefactors of Europe. Their huge and magnificent Abbey church at Cluny, near Lyons, was one of the most famous buildings in the world. It took forty years, about the end of the eleventh century, to build, and after giving joy and inspiration to men for seven hundred years, was torn down by the citizens of Cluny in Revolutionary frenzy.

The church, as we can well understand, was the centre of every monastic establishment. On it the monkish artists spent their many talents, and in many cases very real genius. Around the church, like houses about a village green, clustered the rest of the buildings that were necessary for the life and maintenance of a large and inclosed and self-supporting community.

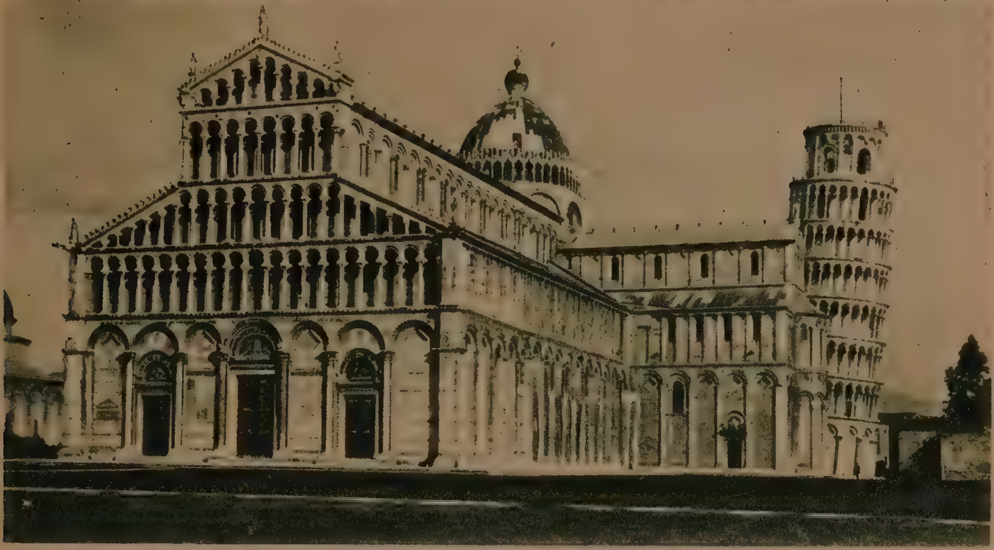
The cloister court separated the church from the kitchens and dining-halls, and this pillared space added a dignity of its own to the sacred building. In addition to the actual dwellings of the monks, which contained interesting apartments like those set apart for the brothers who were illuminating manuscripts, there were the guest houses, infirmary, prison or punishment cells, stables, granaries, bakehouse, mills, workshops. All these buildings were nobly set up in the Romanesque style.

There are remains of monastic settlements like these at Fountains Abbey in Yorkshire, England, where one can walk through the ruined spaces and picture the busy, ordered, monastic life that flourished there from its founding in 1132 to its break-up in the sixteenth century by the order of Henry VIII.

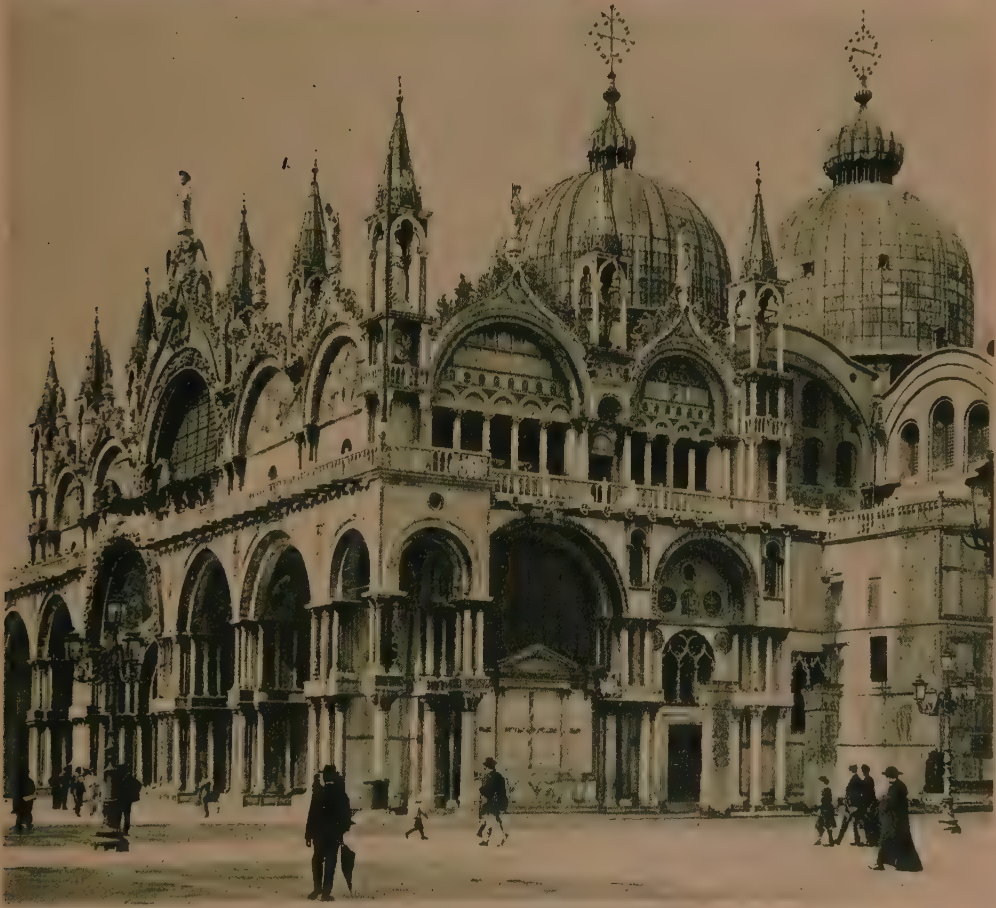
These great masses of buildings had naturally a great effect on the architecture of the day. Cluny Abbey church is said to have served for a model of all Europe, and been imitated even in the Holy Land. All over France memorable and sacred buildings arose, set up by the monks of various orders. To go from one to the other is to follow a trail of beauty for whose creation we shall never cease to be thankful.

Architecturally, the river Loire seemed to divide France in half. South of the river is the greater richness, where the Cluniac influence was strong, and also

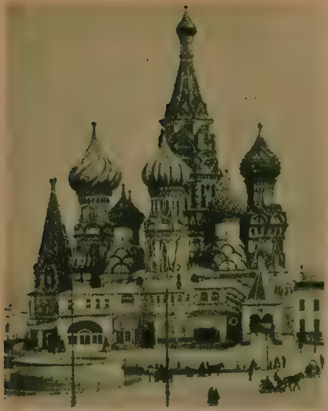
THREE GREAT STYLES OF BUILDING



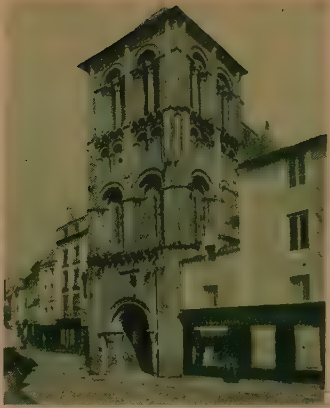
THE IMPRESSIVE CATHEDRAL OF PISA AND THE LEANING TOWER



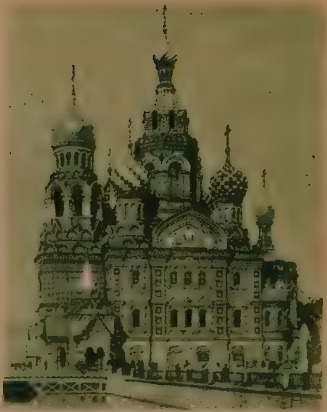
THE CATHEDRAL OF ST. MARK'S AT VENICE



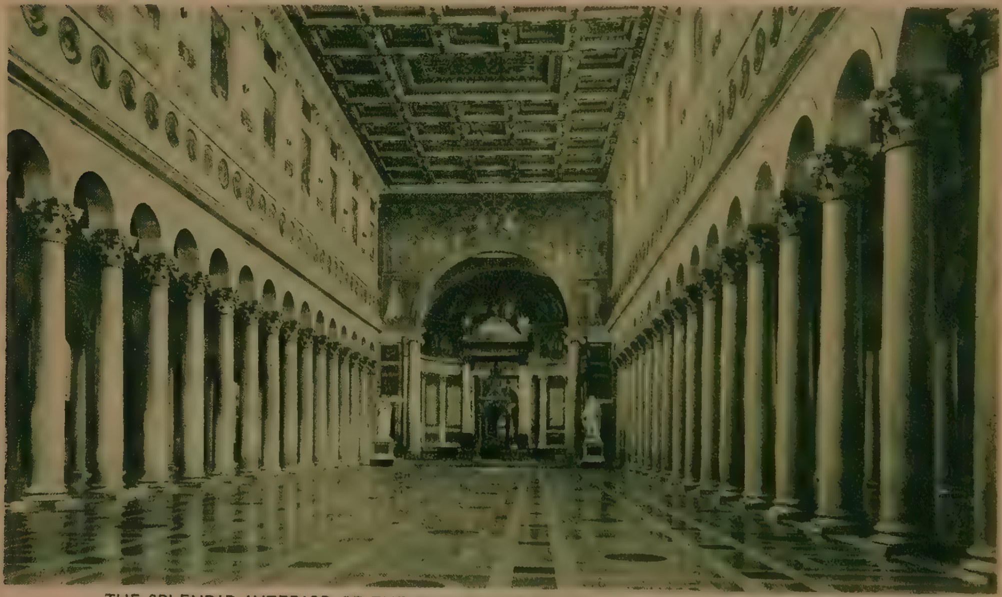
THE CHURCH OF ST. BASIL AT MOSCOW



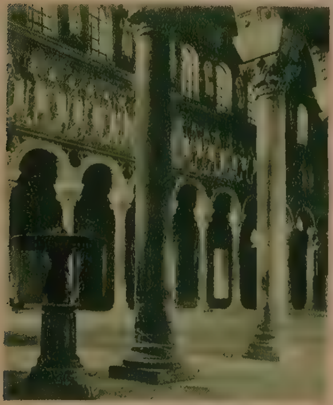
THE ROMANESQUE TOWER OF ST. PORCHAIRE CHURCH, POITIERS



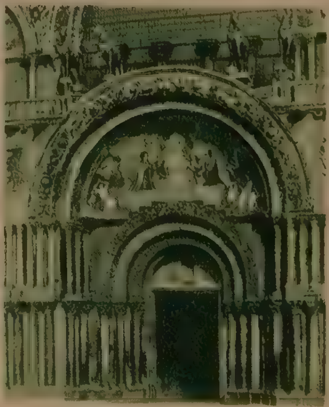
THE CATHEDRAL OF THE RESURRECTION AT PETROGRAD



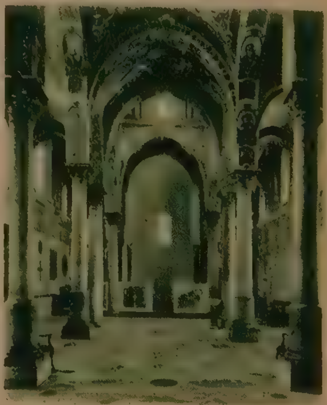
THE SPLENDID INTERIOR OF THE BASILICA OF ST. PAUL-OUTSIDE-THE-WALLS AT ROME



ST. APOLLINARE NUOVO AT RAVENNA



THE DOORWAY OF ST. MARK'S AT VENICE



THE CHURCH OF LA MARTORANA AT PALERMO

THE SOUTH SIDE OF AIX-LA-CHAPELLE CATHEDRAL

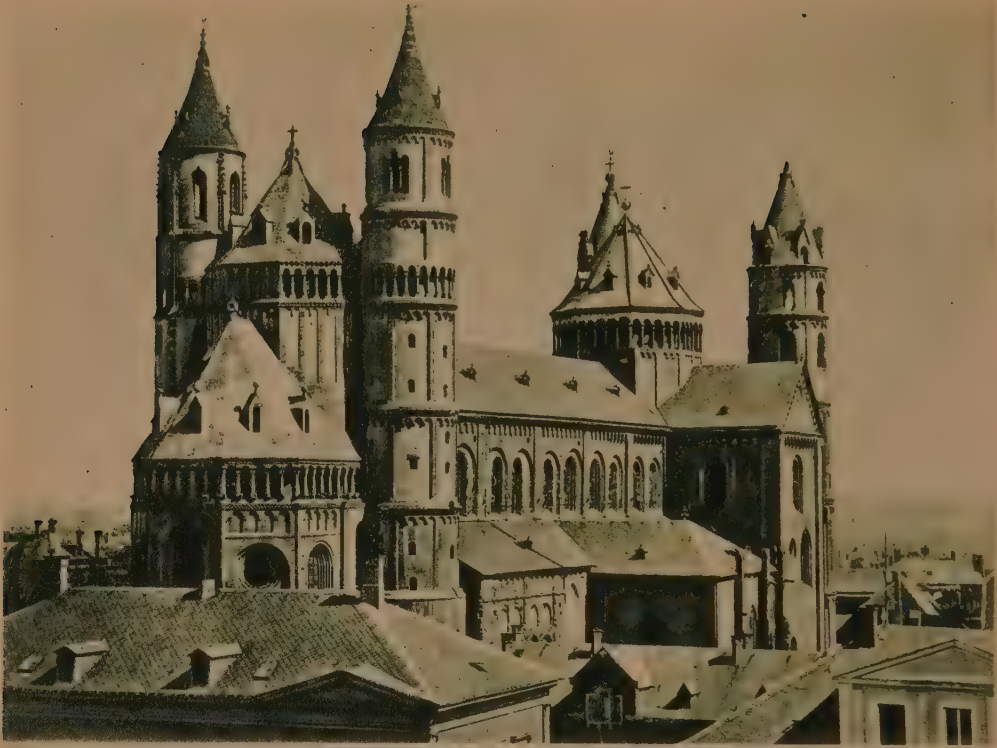
THE CHURCH AND MONASTERY AT DAPHNE, IN GREECE

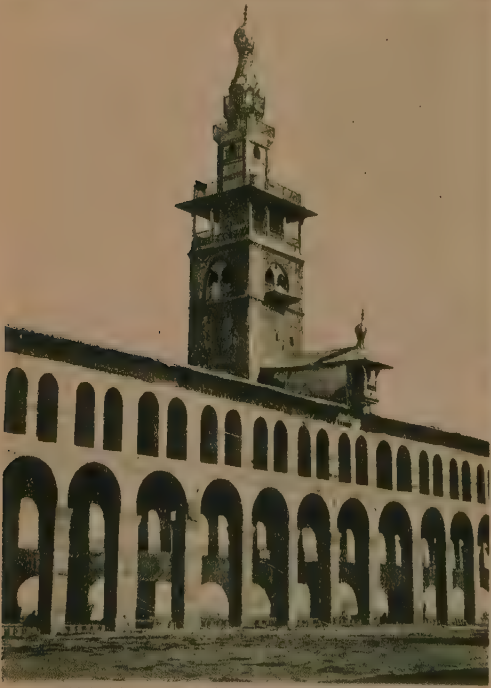
THE SPLENDID CATHEDRAL AT PALERMO

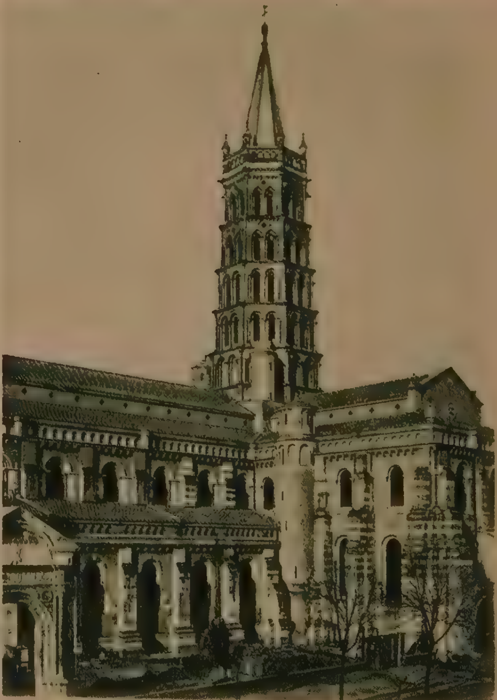
A ROMANESQUE CAPITAL AT MONREALE

THE INTERIOR OF THE CATHEDRAL AT AVIGNON

A WINDOW OF ST. AGOSTINO CHURCH, PALERMO


THE CATHEDRAL OF WORMS, IN GERMANY


CLOISTERS OF THE GREAT MOSQUE, DAMASCUS


THE CHURCH OF ST. SERNIN AT TOULOUSE

The pictures in these pages are reproduced by courtesy of Messrs. Alinari, E.N.A., Mansell, McLeish, and others.

where Byzantine and pagan beauties still exerted a power. There were lovely capitals and columns to be had from discarded Roman buildings, fine masses of stone and marble. These churches of the south were consequently marked by most beautiful cloisters and very rich façades, or fronts. There were generally three doorways, each surmounted by, not one rounded outline, but many; arch after arch falling back into the thickness of the wall, each with its pillar and carved capital.

There is something in the shape of the pure Romanesque doorway that no later architecture has achieved. It may be the exceeding charm of the low swing of the arch, from point to point of which the eye goes and comes, and is conscious of restfulness, of repose, of something returning upon itself, in Nature's mysterious way. People who watch the sea feel just the same kind of magic in the semicircular, swinging trough between two wave crests.

WHY THE BUILDINGS OF NORTHERN FRANCE ARE SO SEVERE

In the north of France, where the thoughts of architects were not so much affected by the richness of an earlier empire, the buildings were sterner, more severe. There are very few anywhere whose fabric is not touched in some part by so-called improvers of a later era. North of the Loire the most important Romanesque buildings are the two Abbey churches of Caen—l'Abbaye-aux-Dames, founded by Matilda, wife of the Conqueror, and l'Abbaye-aux-Hommes, also known as St. Etienne, begun by the Conqueror himself.

Near Paris is the Abbey church of St. Denis, on which a fine early Gothic architect, Abbé Suger, worked. St. Germain-des-Prés has managed to maintain its Romanesque look through many intervening centuries. South of the Loire are many wonderful piles like those of St. Madeleine, at Vézelay; St. Gilles and St. Trophime, at Arles; Notre Dame, at Avignon; St. Sernin, at Toulouse; and Angoulême Cathedral.

In Italy the greatest triumph of the Romanesque period was the famous group at Pisa—the cathedral, the circular baptistery, and the campanile known as the Leaning Tower. In Sicily the fine cathedral of Monreale, near Palermo, shows a mixture of Early Christian, Byzantine and Romanesque influence. San Miniato, in Florence, San Michele, in Pavia, San Zeno Maggiore, in Verona, and the Baptistery at Cremona show respectively the varying appearance of Italian Romanesque architecture. Here the basilican influence lingered far longer than it did north of the Alps.

THE CHURCHES IN GERMANY BUILT ON EARLY CHRISTIAN LINES

A certain amount of Romanesque architecture appeared in Germany, principally in Saxony and the Rhineland. Charlemagne forced the Saxons to become Christian, and hence in this province a number of baptisteries were built on Early Christian lines. Circular churches arose with the sanctuary thrown out at the end.

Charlemagne had a strong feeling for architectural beauty, and he strove to awake in the German provinces something of the impulse for building fine churches that was so strong in Southern Europe.

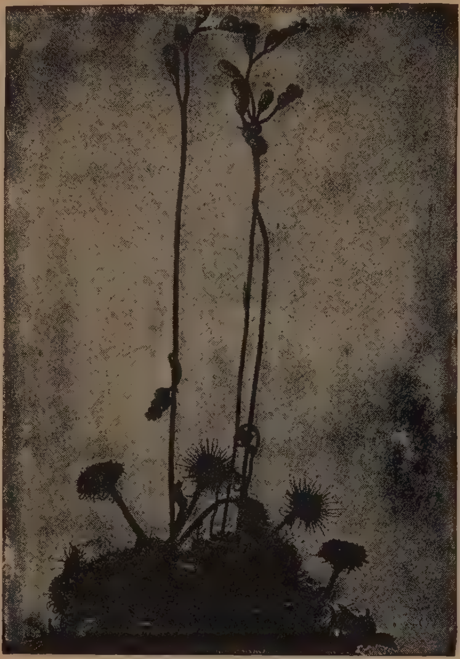
The Cathedral at Aix-la-Chapelle rose at his orders, Charlemagne foreseeing that this building might presently serve as his tomb-house; and it would have been a fine record of Romanesque work if it had not been so much altered and improved in successive centuries. The original quaint polygonal body of the church remains, and architects think that it was probably modeled on San Vitale, Ravenna.

A PECULIAR FEATURE OF GERMAN ROMANESQUE ARCHITECTURE

One of the peculiarities of German Romanesque architecture is the double-apsed church—that is to say, a church with an apse both at the east and at the west end. Gernrode Abbey is the first built in this way. In other countries, apses were used in the east end only, and thus the western end of the church could be devoted to the entrance façade. German architects placed their portals in the side of the church and richly ornamented them. And as they early showed their liking for round and octagonal turrets and many-sided domes, their buildings of this period are more picturesque than dignified.

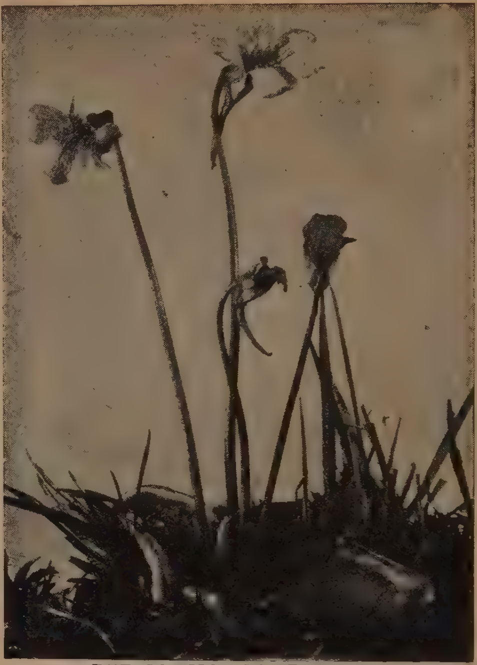
The cathedrals of Worms, Spires and Mayence are typical of the German feeling. The cathedral at Trèves is an interesting church in an interesting city.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 5963.



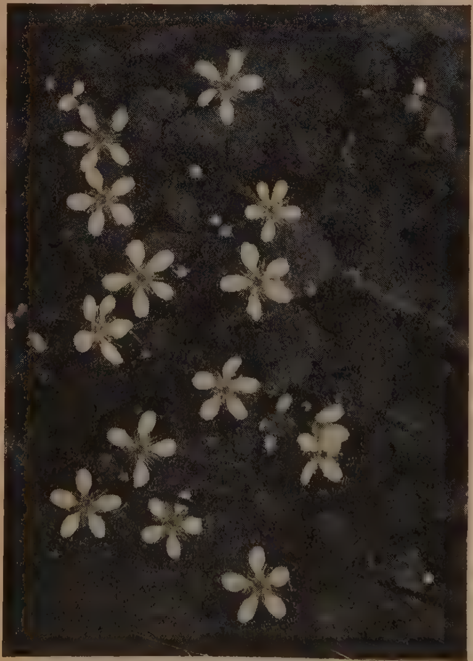
THE ROUND-LEAVED SUNDEW

We can see in greater detail how the insect-eating plant is attracted to flesh by the pictures on page 742. Wonderful powers used to be attributed to it.



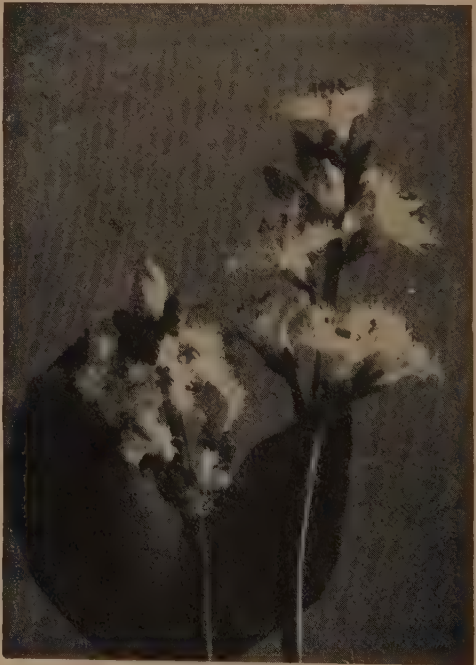
THE COMMON BUTTERWORT

This is another of our insect-eating plants. The frosted-looking leaves and the violet flowers give a striking appearance. It grows in the North.



THE BLACKBERRY

The blackberry blossom discloses its family relationship by its likeness to a single rose with white crumpled petals. The flowers are scentless and very abundant.



THE BUCK-BEAN

The Buck-bean, also called the Bog-bean and the Marsh Trefoil, is one of the handsomest flowers of the bogland. Its flowers are white, tipped with pink, and as many as twelve grow on one spike.

THE FLOWERS OF THE MARSHES

TO some extent the flowers of the bog and marsh are the same as those of the streamside. This, of course, is only what one would expect when it is considered that the reason for their existence in either place is their liking for abundant moisture at the roots.

Botanists call them *hydrophytes*, or water plants; while those of the uplands are mostly *xerophytes*, or dry plants; and those of the hedgerow, field and wood are mainly *mesophytes*, or medium plants, because they like a soil that is neither too wet nor too dry. Therefore, when we are hunting for flowers around boggy land, we must not be surprised if we again meet with old friends of the streamside.

The soil of the bog is mainly peat, which is composed of the remains of plants that have grown on the spot. In most bogs we shall find a certain kind of moss known as Sphagnum, or Bog-moss, which grows in great quantities, the branches of each plant loosely interlocking with those of its neighbors, so that they become like a huge sponge, holding much water. If we pull up a handful of bog-moss and squeeze it, we shall get a clear idea of this. The bog-moss grows to a great length, always fresh green at the top and dead at the bottom. The pressure of the new growths upon the old gradually turns the lower part into peat, which fills up the wet hollow where the bog began. When dried, peat makes good fuel, but just now we are more interested in the flowers that may be found in the bogs and in marshy places. The bog-moss is not a flowering plant; but we may be interested in looking for its fruits, which are red and round, about the size of a medium-sized shot, standing on slender stalks above the plant.

Among the most curious of the bog plants are the Sundews. As flowering plants they are not very striking, for their blossoms are small and white. In this case it is the leaves that awaken our interest and wonder. We have several kinds—as the oblong-leaved, the spatulate-leaved and the thread-leaved sundews. The round-leaved sundew has a small rootstock and not much in the way of roots; but little more than is needed to hold it securely in the soil.

It has other means of getting its food, as we shall see. From the rootstock all around range a dozen or more leaves on long hairy leaf-stalks. The leaf proper is sometimes half an inch across, while the leaf-stalk frequently measures an inch and a half long. The round leaf-blade is studded all over with long crimson filaments, with a glandular knob at the tip of each. From this knob there is poured out a clear sticky fluid, which can be drawn out into long threads as though it were a very good sort of liquid gum.

This gum, as we may call it, glitters in the sunshine, and, in combination with the red color of the leaves, makes these appear more like flowers sprinkled with dewdrops. They also look not unlike small sea-anemones, though it is not likely that they present such an appearance to the insects that visit them; but their action is much like that of an anemone.

Now, the sundew is so clever that it can tell the difference between things that will serve it as food and things that will not. If upon a fully open leaf we drop a particle of stone or glass, nothing will happen, which shows that the leaf has got some sense of taste or smell. But if we were to drop upon it the smallest fragment of meat, or even a snippet of hair, it will know that the substance is *animal*, and will bend its tentacles toward it and envelop it.

THE WRINKLED FOLIAGE OF THE HAIRY BONESET

The great grayish hairy Boneset is a striking plant of wet places. Its deeply wrinkled foliage and great flowering tops, made up of tiny dull white florets in little heads, were utilized by country folk as a favorite medicine, perhaps aiding the setting of bones by keeping the patient in good health. Its other name, Thoroughwort, refers to the way in which the tall stem appears to pierce the centre of a long, double-pointed leaf—an appearance caused by the union of the bases of a pair of exactly opposite leaves.

THE WHITE-FRINGED FLOWER OF THE BUCK-BEAN, OR BOG-BEAN

One of the most lovely of these little-known bog flowers is the Buck-bean, or Bog-bean. We shall know it at once if we remember its name, *Menyanthes trifoliata,* because its large leaves are broken up into three leaflets, and look like the leaves of the broad bean. These leaves come from a thick, creeping rootstock, from the middle of which rises a stout flower-stem bearing white or pink funnel-shaped flowers, the lobes of the corolla covered with fleshy fringes which give them a peculiarly delicate and feathery appearance, and the stamens red. These should be sought from May to July in the long grass of the swamp.

THE YELLOW MARSH-MARIGOLD, OR KINGCUP

If our visit to the bog is in spring, we shall find parts of it turned to gold by the rich yellow flowers of the Marsh-marigold. This is one of the Buttercup Family, as we shall soon see by the flowers. They are like huge buttercups, two inches across. There is a thick, creeping rootstock that roots as it goes, and sends up thick stems and large glossy kidney-shaped leaves that increase in size after flowering.

The flower has no petals, but the sepals are colored and enlarged, and serve as well as petals. There are many golden stamens, and nectar is poured out abundantly at the base of the pistils, and attracts beetles, flies and bees. Another name for the marsh-marigold, given to it in many districts, is the Kingcup.

THE LILAC COLORED FLOWERS OF THE MARSH-VIOLET

About the same time we may find the Marsh-violet in flower. Its leaves are broader than those of the sweet and dog violets, more kidney-shaped than heart-shaped, and the lilac-colored flowers stand high above the leaves on very erect stalks. They are not scented, and are sometimes white. The arrangements of the flower are much the same as in the case of the other violets.

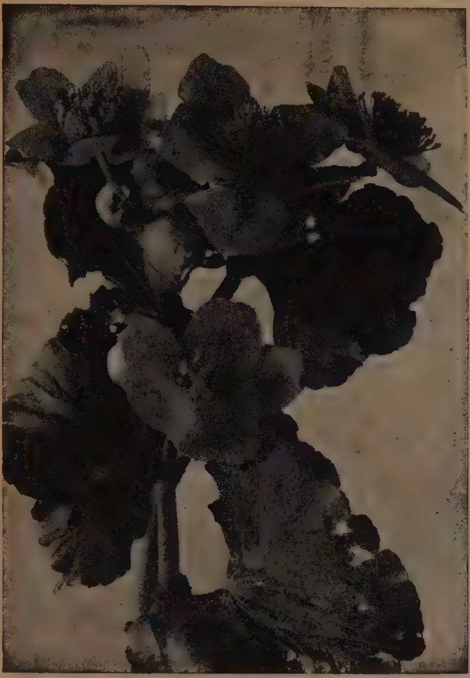
THE BLACK SNAKEROOT, SOMETIMES CALLED BLACK COHOSH

The Black Snakeroot, or Black Cohosh, shoots up in dark woods, as tall as a man. Its thick, knotted, fibrous roots are used in medicine. The leaves are made up of many small leaflets, and the tall flower-stalks are slender, pointed, and studded with delicate white tufts, which one may discover to be clusters of thread-like stamens thrust out from flowers, whose sepals and petals are so small as to be hardly noticed, or have fallen away.

THE FERN-LIKE MEADOW-RUES AND DELICATE SPIRÆA

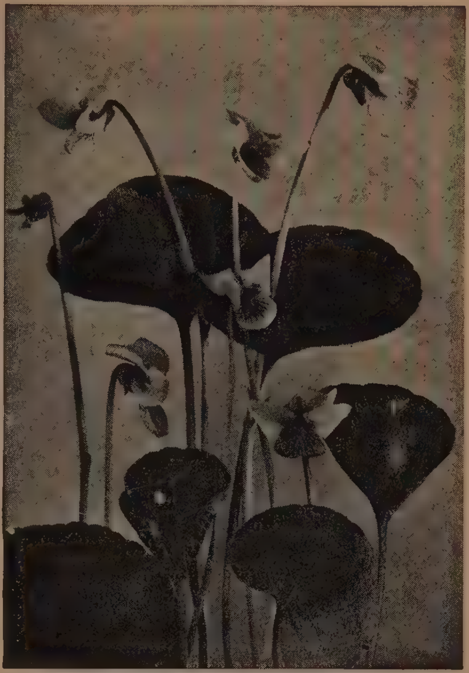
A group of herbs, the Meadow-rues, is so called from a similarity in their delicate, fern-like foliage, made up of small leaflets, to that of the garden-rue. They bear great branching clusters of tassel-like little flowers in which only the quivering groups of long stamens are noticeable. One kind blooms early on rocky hillsides, while another, with snowy white flowers, rears them high in meadow-lands, on very wet places.

FLOWERS OF THE MARSHES



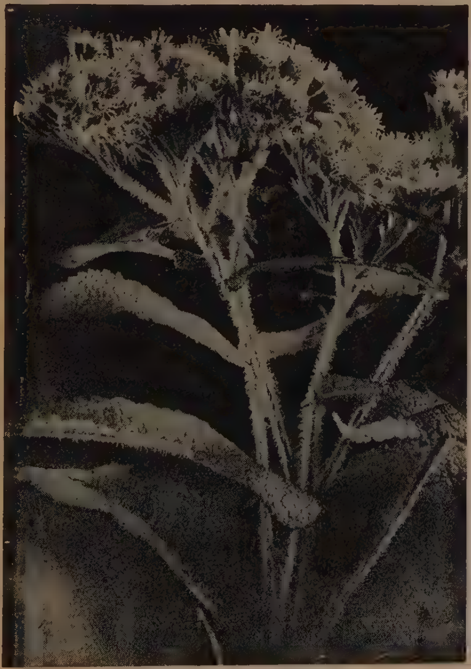
THE MARSH-MARIGOLD

In boggy and marshy places the Marsh-marigold, with its bright yellow flowers, is a conspicuous plant. After the plant has flowered, the leaves increase.



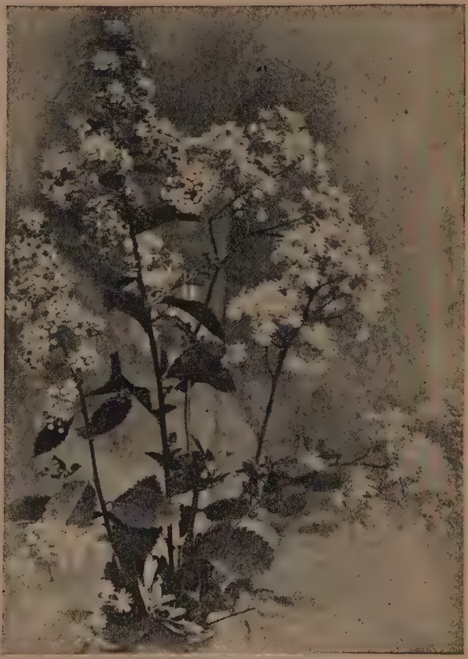
THE MARSH-VIOLET

The flowers of the unscented Marsh-violet, which grows principally in the North, are paler than those of the sweet violet. They are either lilac or white.



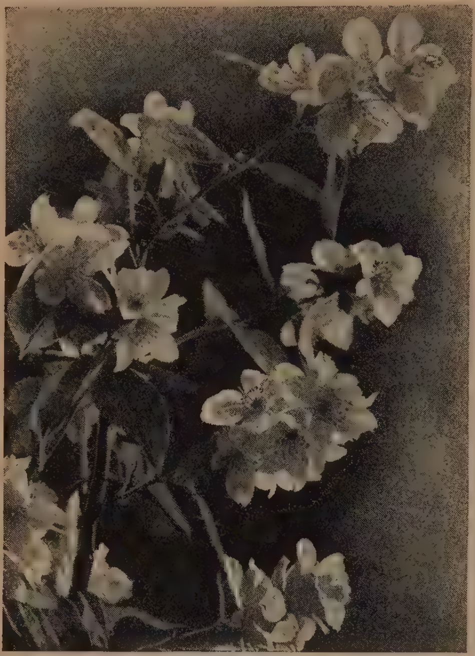
THE HAIRY BONESET

The Boneset, or Thoroughwort, was a medicinal plant of high repute with our grandmothers, who would gather it for their healing tea.



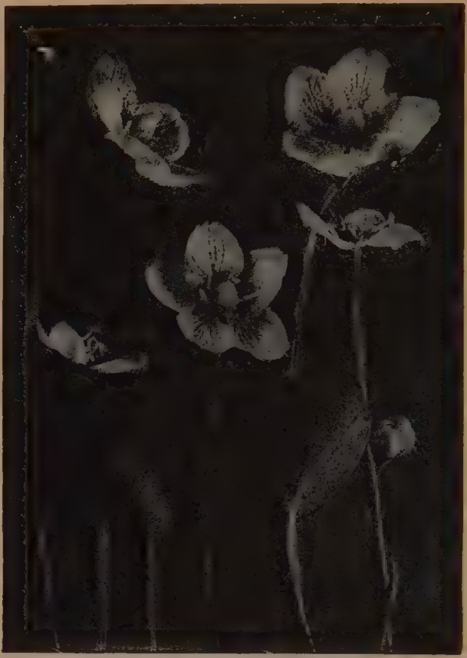
THE MEADOW-RUE

The Meadow-rue takes its name from its resemblance, in leaves, to the rue of our gardens. The name rue is old and its derivation obscure.



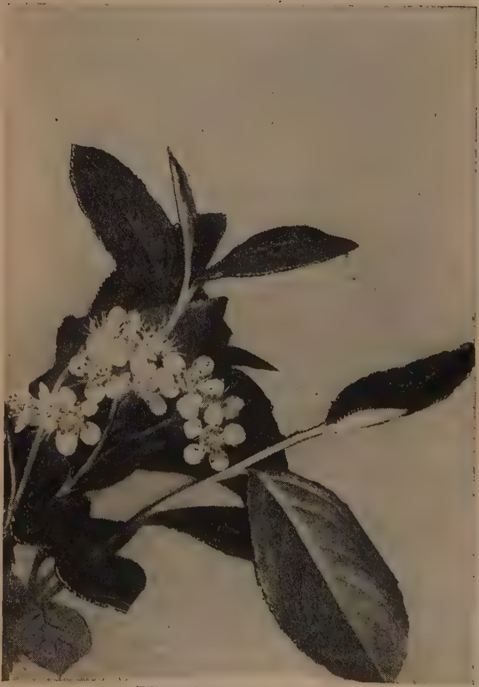
THE SYRINGA

The fragrant Syringa is a native of Central Europe. It has escaped from gardens in Virginia and Ohio, and sometimes in central and eastern United States.



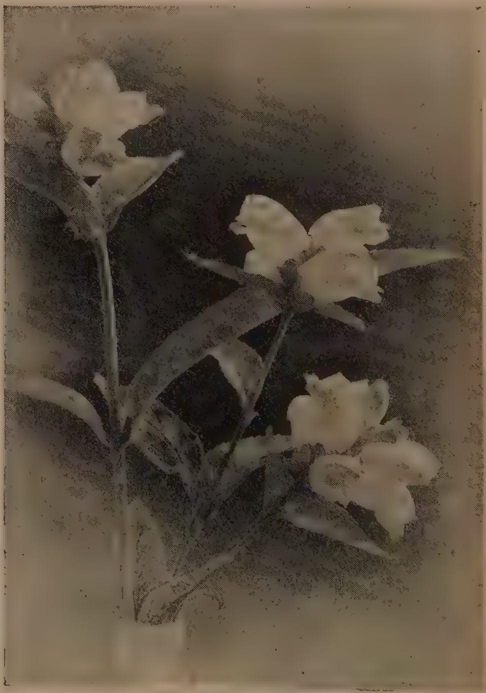
THE GRASS OF PARNASSUS

This beautiful plant is not a grass, but a member of the Saxifrage Family. The heart-shaped leaves grow on long stalks; the flowers are white.



THE CHOKEBERRY

The Chokeberry, a near relative of the meadow-sweet, is most often found on the edges of ponds. Its berries are edible but dry and choking.



THE TURTLEHEAD

The curious white flowers of this plant look like the head of a turtle, and hence the name; and like its namesake, the plant is to be found in wet places.

THE BIRD'S-EYE PRIMROSE

Certain bogland plants are found principally on the shores and cliffs of northern United States and Canada. Among them is the Bird's-eye Primrose with foliage besprinkled with sulphur-like meal.

THE MARSH CINQUEFOIL

The Marsh Cinquefoil belongs to the Rose Family. It is a stout plant about a foot high with large purplish brown flowers. It is common in European bogs and in northern United States and Canada.

THE MARSH PENNYWORT

This plant is also called the White-rot. Its round, smooth, shining leaves are the most conspicuous part of it, and the flowers, which are small, never rise above the leaves, and so are hard to find.

THE WILD ANGELICA

The flowers of the Wild Angelica, white tinged with pink, are a familiar sight in European swamps. The plant is tall and makes a good yellow dye. We have about twenty species of Angelica here.

Close by one will often find the delicate American Meadow-sweet, one of the spiræas, quite a large bush, with slender branches bent down by the pointed, open clusters of bloom at their ends. The florets are flesh-tinted in the bud, growing paler as they open, and are like miniature apple blossoms. The bush may easily be transplanted to a damp spot in the garden, and will flourish wonderfully.

THE CHOKEBERRY IS A RELATIVE OF THE SPIRÆA

Another shrub, closely related to the spiræa, and with white tiny apple-like flowers, but arranged in flat clusters, is the Chokeberry, that has small oval or obovate leaves sharply saw-toothed on the edges. It grows knee- or even waist-high, and often stands in water in woods or bogs. Late in summer the little bushes are loaded with red or nearly black berries, juicy and insipid, not larger than a pea, and either pear-shaped or globular.

THE QUAINT FLOWERS OF THE TURTLEHEAD

The edges of a marsh often seem to have sheets of dull white laid over them, due to crowds of the quaint Turtleheads. The slender stems, bearing pairs of glossy leaves, are topped by thickly crowded, odd-shaped blossoms, quite plainly suggesting in their shape the pointed jaw of a turtle, and also resembling a snapdragon, to which they are closely allied. But instead of being black and wrinkled, or brilliantly tinted, the floral turtleheads are of the texture and bluish whiteness of china; only about the woolly mouths are the flowers faintly touched with rosy purple.

THE BRIGHT BLUE BLOSSOMS OF THE FRINGED GENTIAN

They bloom rather late, but perhaps the loveliest of all the autumnal flowers are the Fringed Gentians. One is not always certain to find them in the same place year after year, for they seem to change from one wet meadow to another, but they are worth hunting for, and often grow in large colonies. The whole plant is glossy, with smooth narrow leaves, and the branches stand straight up and close together, bearing dozens of the bright blue blossoms. The buds are almost square, the four petals being twisted into a cone on top, but when they open in the sunshine, the lids of the box, as it were, flare widely, edged with most exquisite fringes. They are cautious flowers, and at the touch of night's cool fingers twist up their petals again, thus protecting the delicate stamens and pistil, at the bottom of the box, against frost. The sun, next day, causes them to open again, and they will do this several times before they wither away. The fringed gentian is very closely allied to the gentians of the Alps that bloom near the everlasting snows, and also to one of the curious plants of our swamps, the closed gentian—another glossy plant, with closed blue flowers clustered about the stem—flowers that always look like buds, as there is only a tiny aperture at the top of the tubular blossom.

THE GRASS OF PARNASSUS GROWS IN BOGS

The Grass of Parnassus is another beautiful bog flower, a member of the Saxifrage Family. Its leaves are oval, with pointed tip and heart-shaped base. They spring in a circle from the rootstock, and stand almost erect on long stalks.

The flower-stem is much longer than the leaves, and bears one flower at its summit. This is about an inch across, the five white petals being of rather thick substance and finely streaked with green. The large pistil is in the centre of the flower, and around it are five stamens. A fringe of imperfect stamens surrounds the green pistil like a trellis, and in climbing over this the bee or fly is apt to leave some pollen behind.

The European flower of this name, fabled to have grown up on Mount Parnassus, is at home here only in the Canadian border provinces and northward.

THE SPIRALLY TWISTED LADIES' TRESSES

A swamp, especially a mossy cranberry bog, is just the place to look for many of our orchids, but the Ladies' Tresses are generally content with damp meadows, or even dry pastures. There is one common variety, however, known without much reason as the Nodding Ladies' Tresses, which is found in very wet soil, in marshes, or even in running water. A form of it, blooming in October, is very tall and strong-scented, and has cream-colored buds. Its flowers have a frosted appearance and are so arranged that the spike of flowers looks square in outline.

THE BIRD'S-EYE PRIMROSE COMMON TO EUROPE AND AMERICA

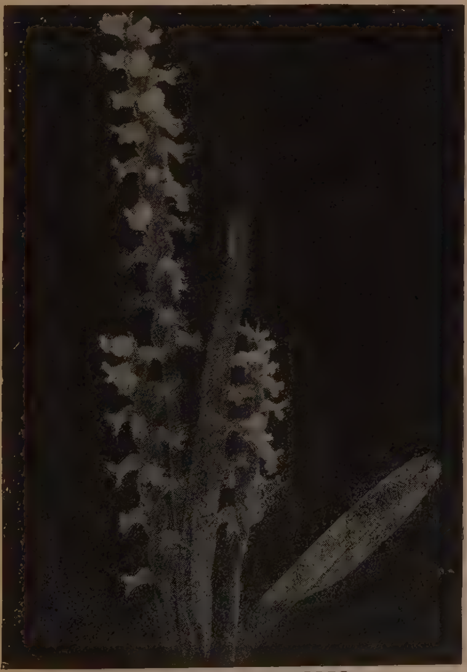
On the cliffs and shores of Maine and Quebec, and as far west as Michigan and

THE BOG-MYRTLE

The Sweet Gale, or Bog-myrtle, is a bushy plant that flowers before it is in leaf. The bitter leaves were once used in place of hops, and scent clothes.

THE SWAMP IRIS

The Swamp Iris (Versicolor) transforms our wet lands in springtime with its strikingly beautiful blue spikes.



THE LADIES' TRESSES

This exquisite spire of blossoms, that seem braided together, holds its head above the green grass of meadows in late summer, and is almost the loveliest of American orchids. Its flowers appear frosted.

THE COMMON COTTON-GRASS

In the boggy districts here and there we often see what appear to be tufts of white cotton covering the ground. This is Cotton-grass. Attempts made to spin it have failed, but it is used for stuffing pillows.

Minnesota, there is a pretty little primrose called the Bird's-eye Primrose, or Mealy Primrose, whose leaves are covered on the under-sides with a white or pale yellow powder.

The whole plant looks much more like the garden auricula than the common primrose of the woods, for its lilac or pale purple flowers are clustered, like those of the cowslip, at the top of a short stalk, a few inches above the unwrinkled leaves. It flowers in June and July, and gets its name of bird's-eye from a patch of yellow which is found around the mouth of the corolla-tube.

THE PURPLE-BROWN MARSH CINQUEFOIL

A purple-flowered relative of the common silverweed and barren strawberry grows in bogs in the northern United States and Canada. It is known as the Marsh Cinquefoil. It has a long woody root, like the yellow-flowered cinquefoil of the meadow, and, like it also, has its leaves divided into five or seven leaflets.

The rather pretty flowers are magenta-purple within and palish purple without, because of the green sepals which are longer than the petals. This flower can be found in wet places during June, July and August in the New England states and west to California. In the Middle Ages it was believed that the flower had power to cure various ills.

THE DARK GREEN LEAVES OF THE MARSH PENNYWORT

On the bog-moss we shall find a number of round dark green leaves from half an inch to two inches across, but with no stalk visible. If we pull one up, we shall see the reason for this. The stalk is there, but fixed in the middle of the leaf underneath. This is the Marsh Pennywort.

There is a slender stem which creeps through the moss, and, as it is hidden from the light, it is white. In the summer-time we may find its tiny cluster of pinkish green flowers. It is one of the Umbel-bearing Family, but it does not look as though it were related in the least degree to the cow-parsnip.

THE PIPE-LIKE STEM OF THE ANGELICA

Another umbel-bearer that we may find on the borders of the bog, as well as in damp places in woods, is the Wild Angelica, which we shall have no trouble at all in placing in its proper family.

It grows to a height of five or six feet, with a thick, jointed pipe-like stem, often of a purple tint. Its large wedge-shaped leaves are often a couple of feet in length, much divided, as are the leaves of most plants of this family. The umbels of white or purplish flowers are very large.

THE RED BERRIES OF THE CRANBERRY

In some parts of the country we shall find the Cranberry, a relative of the bilberry and cowberry. The evergreen leaves and the flowers are very similar, but the stems creep, the flowers are pale pink in color, and the berries are dark red and extremely acid to the taste. We may read more about these on page 2068.

THE FRAGRANT SWAMP MILKWEED KNOWN BY ITS MILKY FLUID

There are a number of Milkweeds, plants so called, as one can readily see, from the milk-white and very sticky juice that runs out of the leaves and stalks when bruised. They have small flowers, each of which is very unusual and curious in its appearance, gathered in umbels, as the clusters are called when the stalks all start from one spot, just as the ribs of an umbrella all spring from a tiny circle. Some of the umbels droop like great tassels, while others are stiffer and more upright. The Swamp Milkweed bears umbels of this latter kind, and is one of the prettiest of all. Its flowers are purple-pink and fragrant, and its very leafy stems are two or three feet high with narrowly oblong pointed leaves. In its tough stems is a grayish fibre so strong that it might be used like hemp, for ropes.

THE GORGEOUS FLOWERS OF THE SALT MARSHES

In late summer, marshes, especially salt marshes, glow with countless yellow composites, such as sunflowers and beggar-ticks, often woven together by strands of the climbing boneset, burdened by bunches of pale pink flowers, or by the viciously armed "tear-thumb." Deeper in the marsh are white-flowered arrowheads with their quaint triangular long-tailed leaves, the blazing velvety spikes of cardinal-flowers and the flaunting swamp-rose-mallow, whose great bell-shaped flowers, rose-colored and stained within with a deeper tint, show their near relationship to the hollyhock. There, too, is the rich deep purple ironweed, its many flower-heads all glowing against a background of green cat-tails.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 5871.

Photo, courtesy White Mountain Eskimo Sled Dog Kennels.

Labrador Eskimo pups and their young master, a little white boy.

DOGS WHO HAVE DONE THEIR BIT

IS there a child anywhere in the wide world who does not love a good dog? Perhaps some of you have heard about Balto, that remarkable "husky" (the name for dog in the Eskimo language) whose bravery saved many lives. In the middle of the winter the far-off city of Alaska called Nome was visited with a terrible sickness, which only one remedy could check. There was only a little of this medicine in Nome, and if it had not been for Balto the fresh supply would not have arrived in time.

There have been books and verses written about dogs and pictures painted of dogs, but very seldom has there been a statue raised to a dog. The dog Balto has had a monument erected to the memory of his faithful courage and his magnificent strength, in Central Park, New York City. And what did he do? We must go back a little way because we have come to the end of the story first. When the precious serum which was so desperately needed in Nome had been sent as far as Nenana, it was still 650 miles from Nome. Then the serum was rushed forward by dog-teams and champion drivers as fast and as far as human and dog endurance could carry it. Kasson, the last driver of the stout-hearted lot, missed his relay in a blizzard and came on into Nome, his great strength almost gone. On the last lap the thermometer stood at 30° below zero, with a blinding gale blowing from the northwest. Kasson could no longer see his dogs or the trail; but Balto, the great Siberian, knew the trail and kept it, from Bluff into Nome—fifty-three miles. Kasson said: "I gave Balto, my lead dog, his head and trusted to him. He never once faltered. The credit is his." His feet were badly frozen when the team arrived.

For Balto it was just another entry to be made on his long record as a veteran of the Arctic trails. He started his career in 1915, when he led the Kasson team to victory in the Moose race, and again gained fame when he took Roald Amundsen, the explorer, north from Nome, at the time that the explorer planned his airplane flight across the Pole. He cut the record time from Nenana to Nome from nine days to five and a half days. It is a feat seldom equaled by the seasoned dog-drivers, and gold medals were presented to them. But for Balto a monument!

BOB—A MAN'S BEST FRIEND— WHO ACTED AS LIFE-GUARD

The story of Bob is the story of a dog who loved his master better than his own life. Bob was born in the year 1859 on board a ship bound to England from the Indies. When he was a year old he accompanied his master on board the Manchester, a vessel sailing for the United States. The Manchester, overtaken by storm, was shipwrecked within a few miles of shore, and it was only due to Bob's ability as a swimmer that his master was enabled to gain a rock which jutted up out of the water and afforded the pair temporary safety. Night came on, the tide rose, and still the fierceness of the storm made it impossible for man and dog to reach the shore. The dog's master, realizing the situation, decided to stake all on Bob's intelligence and faithfulness. He placed the key in his jaws, pointed out the distant shore, and motioned for him to take off.

Bob sprang into the turbulent waves, and after a stiff battle reached the shore. He found his way to a farmhouse, roused the inmates—for it was now night—and led them to the shore, where they could hear his master's cries for help. The storm was still raging, and it was impossible to attempt a rescue by means of a boat. A rope was fastened to Bob's neck. The dog needed no telling what to do next. Plunging into the water, he began the return trip to the rock. Time and again he was almost drowned. Grit and endurance won, however, and he reached the rocky ledge just as the tide had begun to creep over it.

A few months later Bob's master embarked upon a second sea voyage and was again shipwrecked. This time all the dog's efforts to rescue him failed. The man was drowned, and Bob himself, after hours spent in the water, was picked up exhausted by fishermen. Later he ran away, boarded a ship bound for Liverpool, and immediately upon arriving in England traveled to London in the vain hope of finding his master.

Bob reached the familiar house near dusk, but a closed door and silence greeted him. Sorrowfully he lay down, and for more than twenty-four hours remained on guard before the entrance to his old home. The next night he became restless and, drawn probably by the smell of the water, wandered down to the river Thames.

At the moment of his arrival a blind man, being led by a small dog on a string, was walking along the bank near the edge. His tiny guide, realizing the danger, endeavored to pull him to safety, but the cord slipped through the man's fingers and with a cry he toppled over into the river. Bob flew to the rescue and soon had him safe on shore.

Bob must have decided that his services were needed about the river, for he took up his abode here and became a self-appointed life-saver. Within a short time he had saved the life of one child, a woman, and a young man who had been robbed and thrown into the water by thieves. By this time he was well-known about the Thames, and officers of the Humane Society, discovering that he was homeless, adopted him and made him a member of the society, at the same time awarding him a medal for conspicuous bravery. Later, he was awarded the gold medal of honor for other heroic deeds, one of which was the rescue of an infant who had been forgotten in a burning building. How much more useful Bob's life was than that of many human beings!

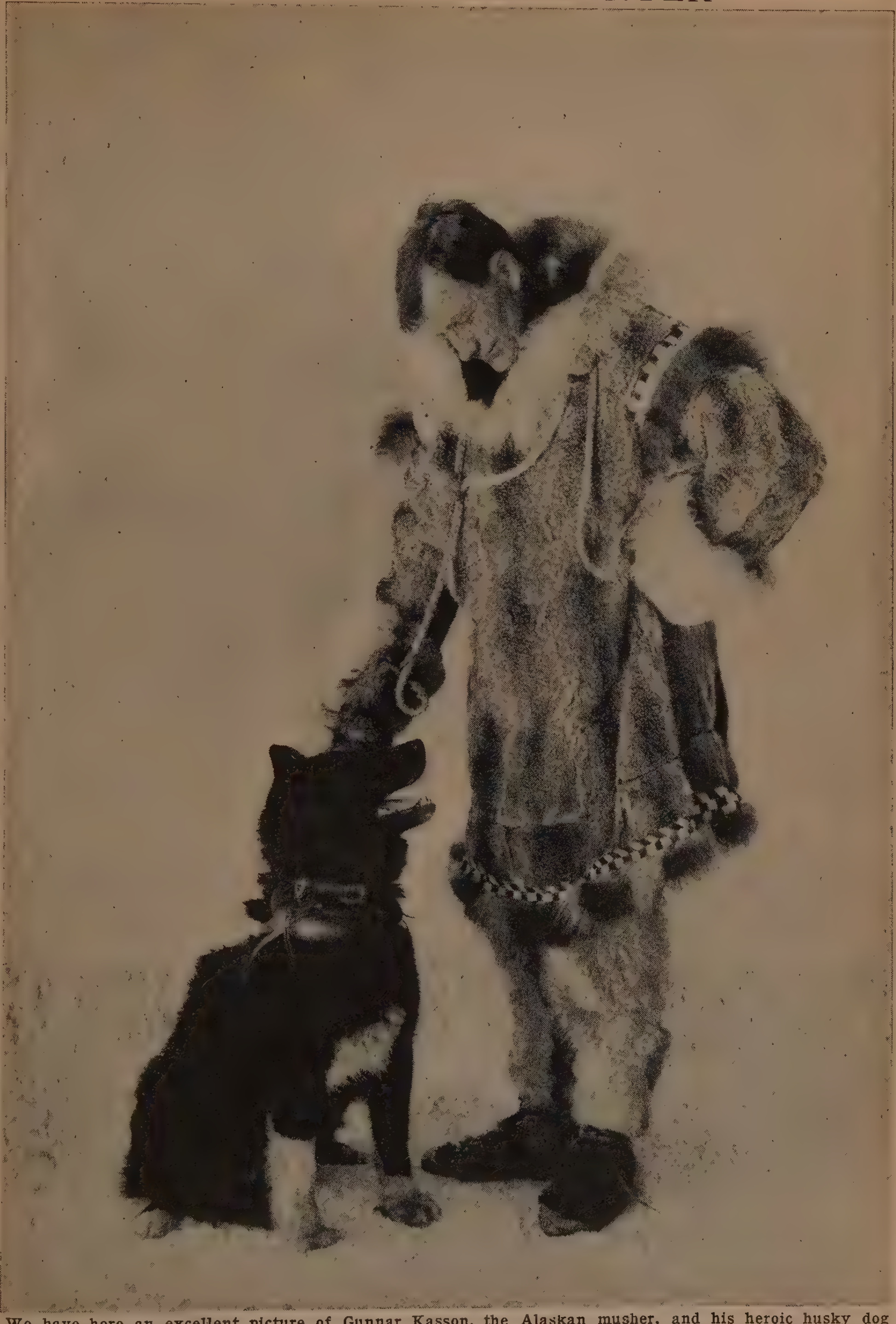
BARRY, A ST. BERNARD DOG, WHO SAVED MANY LIVES

The story of Barry is a glorious one and a sad one. Barry was a wonderful St. Bernard dog who in ten years of heroic service saved the lives of forty travelers, at one time or another lost in the mountain snows of the Swiss Alps.

One of Barry's most famous rescues was that of a ten-year-old child. Barry found the child lying in the snow already in the fatal slumber which precedes death by freezing. He warmed the child with his breath, and then proceeded to lick its hands and face in an attempt to rouse it to consciousness. This was finally accomplished, and when the child opened his eyes Barry lay down by him, and in the language of movement and expression, managed to make the child understand that he wished him to climb to his back. The little lost boy accepted the invitation, and was brought in safety to the hospice.

Barry has been dead some years now, but a monument to the memory of this splendid dog may be seen standing close to the St. Bernard Hospice, where monks take care of travelers who come to them on their way through the pass from Switzerland into Italy. Barry was killed by some unknown person who must have

BALTO AND HIS MASTER



We have here an excellent picture of Gunnar Kasson, the Alaskan musher, and his heroic husky dog Balto. This remarkable pair carried the serum which made possible the checking of an epidemic of diphtheria in Nome, Alaska. After Kasson succumbed to the raging blizzard Balto kept the trail, saving the serum and his master.

Photo, courtesy Loew's Theatres.

thought he was about to be attacked instead of rescued, but he had done his bit.

STIEF, A GERMAN WAR DOG WHO WON THE IRON CROSS

Stief was a German war dog, and his master, a young German lieutenant, was ordered to lead an attack in an extremely dangerous position. He was wounded and lay down in the muck of the battlefield to die. The fire was so deadly that no one dared face it to attempt a rescue. Stief, however, sensing that his master was in trouble, gnawed through his leash and dashed across the bullet-swept field to where he lay. Securing a firm grip on his clothing, he commenced to drag him in, foot by foot. Only once did he release his hold for so much as an instant, and that was when a bullet creased him from shoulder to flank. The dog simply took a fresh hold and finished his job at the edge of the trench.

This is only one of many noble deeds—how many there were we shall never know—which have been performed by courageous and faithful dogs whose loyalty to some beautiful dog ideal has won for them the honored title of "the best friend of man." Stief was given the Iron Cross.

SERGEANT CASEY OF THE SIXTEENTH INFANTRY, U. S. A.—ABSENT

The bugles blared at daybreak one morning at the army post, the colors were run up, and the officer of the day called the names of the guard at reveille on the parade ground. "Sergeant Casey" he called. No answer. Again he pronounced the name. Still no answer. There was a restless movement in the ranks, and the officer, himself amazed, directed that the Sergeant's name go into the guard book as A. W. O. L.

When the ranks broke, the Sergeant's absence was the sole topic. It was unbelievable, the men argued. The Sergeant, who ran away from a good home with a traveling circus, to join the Sixteenth Infantry, had never failed to report before. He had stood every call and every parade since he joined the regiment. He was never in the orderly room, except on business, and he had never been seen to take a drink stronger than water. Gloom enwrapped the regiment, from Colonel F. H. Ford down. Sergeant Casey's perfect record was sullied.

Casey was pictured as vagabonding in forbidden places. Then the mail orderly, a particular chum of the Sergeant, thought to look in Casey's tent. Casey was lying there—he was dead. Dead, and it was he who, ordered to remain behind when the Sixteenth went to France, was the first down the gang-plank at St. Lazaire. The news flashed through the regiment. All were sad at first, but then came the comforting thought that the Sergeant's record at reveille was perfect.

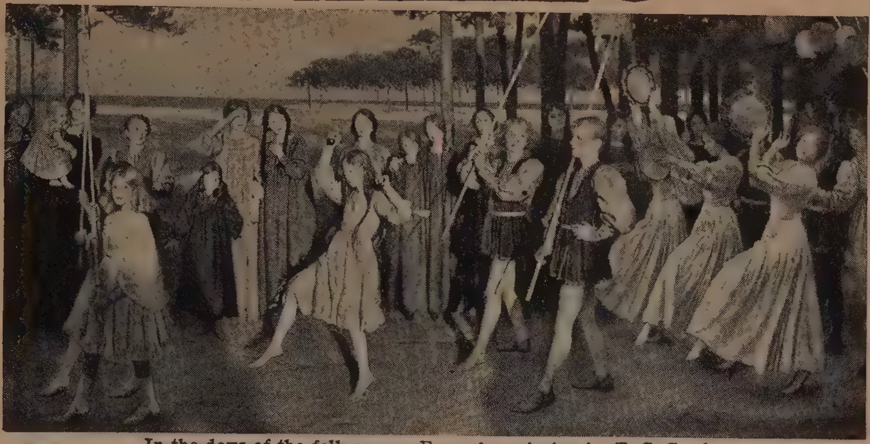
The entire regiment, led by the Colonel, turned out to honor the memory of the Sergeant. Even the "mule skinners" were in the procession that marched with slow steps behind the creaking caisson bearing the body, wrapped in his country's flag.

The procession halted at the cemetery, a neat mound took form and as taps died away the headpiece was put in place. "Sergeant Casey," it read, "Sixteenth Infantry, U. S. A.," and then: "He was only a dog, but he did his bit."

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 6137.

Photo, Ewing Galloway; copyright, Burton Holmes.

Some of the famous St. Bernard dogs at St. Bernard's Hospice in the Swiss Alps.



In the days of the folk song.—From the painting by T. C. Gotch.

WHAT IS A FOLK SONG?

IN a tiny village in England some years ago a gentleman could have been seen sitting on a bench outside one of the beautiful little cottages there. By his side sat the old lady who lived in the cottage. She was singing one of the songs she had heard her mother sing while at work in the house or in the garden. As she sang the traveler took it down, note for note, and word for word, until, after many repetitions, he had the song complete in his notebook.

Never before had that song been written down. No printer had ever seen it. No teacher of music had ever helped to form it. This old lady had heard her mother sing it; her mother had learned it in the same way, and her mother's mother had remembered it from hearing it sung by her mother. So from generation to generation it had been handed down, until now it had come to be written down for printing. That is the true story of a folk song.

It is natural for all races to express their joy or sorrow in song. It is the habit of most happy people to sing at work and play, and this was even more so before motor tractors took the place of horses at the plow, before trains rattled and motors flashed through little villages, before weaving and spinning were done amid the whir and noise of machinery.

Then the weaver sang at his work, and his children learned the song their father sang. As the father made the song to his liking, so the son in his turn shaped it to his taste. The little ornament in the middle which he found difficult to sing he dropped, but he added a little finish of his own. In time his son learned the song and improved it by smoothing away unimportant small notes, while keeping the fine sweep of the melody, and so the process went on, each generation shaping, modifying, expanding, until at last it was found that England had a great national heritage of folk music. Who composed it? Who shall say? The song as we know it is not the song as the weaver first sang it, nor is it the invention of the old lady at the cottage door; it embodies the efforts of generations of Englishmen who have all had a share in creating it.

With the coming of machinery, and the change in industrial conditions, folk music was forgotten. It was driven into the tiny villages where the railway had not penetrated. So completely had it been forgotten that Englishmen were quite ready to agree with other nations when they said the English had no folk music. But about twenty-five years ago some musical people who were convinced that there must be English folk songs somewhere, if they could only be found, visited some of the remotest villages and to their delight discovered a wonderful store of these old melodies.

Then the thought came that there might be some of these songs in other parts of the world where English people had gone long ago. Professor Cecil Sharp, an English musician, spent a summer among the Appalachian Mountains of the United States. Professor Sharp and his associate, Mrs. Campbell, found many songs well known in England. Others differed in words or tune, and, strange to say, he found many which are not now known in England. The ancestors of these people had brought the songs from England or Scotland, and they had been handed down from one generation to the next, though never put in print. A few Scottish folk songs have been preserved in Nova Scotia and Glengarry, Ontario.

WHERE DO PLANTS GET THEIR SALTS FROM?

The salts of plants are necessary to their own lives, and are valuable to us when we eat the plants, or when we eat other animals which eat the plants. There are very few salts in rain-water; but the rain-water, when it becomes what is called soil-water, dissolves into itself everything that can be melted from the earth around it. Exactly what these salts are, must depend on the kind of soil, and this is very important, for some plants require some salts and some require others; so the quality of the soil in various places decides what kinds of plants can or cannot grow there. The plant gets all its water and salts by its roots; and it can get no salts in the solid state, but only those that are dissolved in water. If we want certain plants to grow we often supply salts to the soil, so that they may be dissolved by the soil-water and taken into the body of the plant.

WHY DO WE FORGET WHAT HAPPENED WHEN WE WERE BABIES?

There are many faculties of the mind which we possess only as our brain grows older and gets more exercise. Memory is one of these. We can remember things only by exercising that part of the brain which has to do with memory. Babies have not had time for that faculty to develop, although it grows much earlier in some children than in others. Besides this, the things happening to us when we are babies are all of much the same degree of importance to us. We do not then understand what are the big things in our life and what are not; and one thing makes about as much impression upon us as another. Memory depends largely upon the impression made at the time of the incident; and it is only when the mind is sufficiently developed to judge of the importance of things that memory becomes a well-marked faculty.

IS THERE A REASON FOR EVERYTHING THAT HAPPENS?

It is indeed the first of facts that there is a reason for everything—for the existence of everything, and for everything that ever happens in the world.

The special word for causing is *causation,* and the first and greatest belief of science is that causation is universal, without any exception either in place or in time, either in the conduct of the weather or in the conduct of men. We are apt to take this for granted nowadays, as if it did not need saying, but it has taken all the thought and study of all past ages to prove, and the great majority of people even to-day do not realize that everything has a cause and that consequences are endless. Every effect is the cause of further effects, and every cause or reason of things has its own cause or reason behind it. And so, if we think, we shall soon see that we must go back to the First Cause and All-Reason, the Cause of causes, whom we call God.

DOES THE EARTH EVER BUMP INTO ANYTHING?

The earth certainly never bumps into anything very big, for if it did, considering the rate at which it is going, a catastrophe would result. If it bumped into anything as big as itself, both big balls would be smashed to pieces and become nothing but melted metals and gas. But though the earth never bumps into anything very big, it is constantly bumping into rocks and stones which are flying about in space—or perhaps it would be more correct to say that the earth and the rocks and the stones bump together. Such bumps, however, are of no importance, especially as most of the stones and rocks are consumed by the heat created by friction with the air.

Whether some day in the future the earth will bump into a big body outside the solar system no one can say. At present there is no fear of such a collision; but it is believed that one day the earth and the moon will bump together with a tremendous clash and crash. That day, however, is farther off than we can think.

WHO WERE THE CAPULETS AND THE MONTAGUES?

The name of Capulet is generally associated with that of Montague, though they were enemies. These Italian families lived in Verona, and their deadly rivalries are famous. But they belong to the domain of poetry and fiction rather than to history. Their rivalry is supposed to date back to the year 1300, and Dante mentions their names in his Purgatory.

The Shakespearean tragedy of Romeo, who was a Montague, and Juliet, who was a Capulet, has made the memory of the two families immortal, so deeply human and pathetic is the drama it illustrates. The elements of the play were handed down to Shakespeare by Italian and English writers. Many authors have treated the same theme down to our days. Lope de Vega put it into verse for the Spanish stage; and the Italian musician Bellini and the French composer Gounod used it for grand opera.

WHAT IS THE STORY OF THE BASTILLE?

The name Bastille comes from the French word *bâtir* (formerly *bastir*) meaning "to build." Bastion has the same derivation.

Originally a bastille was a tower built to fortify a town, or to besiege it. To us it means chiefly a prison, from the famous Paris Bastille demolished in the French Revolution. The Bastille, erected in the fourteenth century, was comprised of two huge round towers connected by a fortified doorway. A few years later two new towers were added, then a big ditch, then a bastion, then other towers, until at last it became a strong fortification with dungeons for prisoners of note. When the English were lords of Paris during the Hundred Years' War it was in the Bastille that they first had their quarters. In the fifteenth century King Louis XI turned the fortress into a state prison which was enlarged again and again during the next three hundred years.

In 1789 the French Revolution broke out. The people of Paris were so excited by the abuse of royal power that on July 14 crowds rushed to the Bastille, seized it, and demanded its immediate demolition. Those who now walk across the bridge of the Concord in Paris little think that it was made out of the very stones of the Bastille that had witnessed so many tragedies.

The new French Government, after the fall of the Bastille, decided that a column to Liberty should be erected on the site of the old prison. There it has stood ever since, a national symbol, every year the centre of rejoicings in honor of the liberty won in the Revolution.

HOW, WHEN AND WHERE DID ACADEMIES BEGIN?

The word academy comes from Academus, a legendary Greek hero on whose land were laid out public pleasure gardens which became famous as the meeting-place of Plato and his friends.

It was the fashion in those remote times to give lessons in the open, and masters and pupils generally walked about together. The park of Academus, noted for its flowers, its shady avenues of huge trees and its freedom from the noise of the town, lured all scholars. When Plato died, a statue was erected to him in the park, and his pupils kept up the habit of studying there.

The estate was afterward officially presented to Athens, and it remained a centre for meditation till the Romans conquered Greece and destroyed the splendid old trees to turn their wood into warships. Nowadays nothing is left of the Greek gardens, and scholars are not agreed about its exact site. But since Plato's time the term Academy has been applied to very many places of learning.

Academies flourished especially during the Italian Renaissance, and then spread to France and England.

WHY DID THE ANCIENTS CALL ENGLAND ALBION?

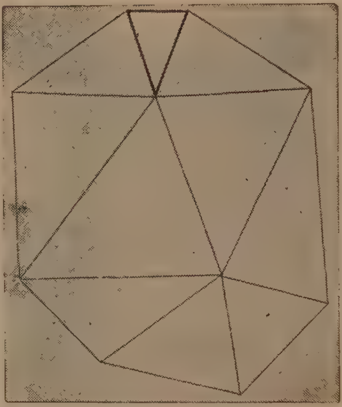
Albion is the name for England given by the Greeks and adopted by the Romans. It appears in the works of Pliny the elder, the famous Latin naturalist and historian. The word Albion is probably Celtic, but the Romans connected it with *albus*, the Latin for "white," and it was given to Britain because of her white cliffs, which impressed the invaders when they first sighted them.

It is not unusual for a land to get its name from the aspect it presents to those who see it for the first time. Quebec is said to come from *Quel bec!* meaning "What a beak!" the exclamation of the French when they first caught sight of the Canadian promontory.

HOW CAN WE MEASURE A WHOLE COUNTRY?

A country is measured and mapped by means of trigonometry—the branch of mathematics dealing with the measurement of triangles. When we know the length of one side of a triangle and the size of the two angles at its ends, we can work out the length of the other two sides of the triangle and the size of the third angle of the triangle.

The side whose length we know is called the base, and the first step taken in measuring a country is to measure a short stretch of ground with a rule. This is used as the base of a triangle which has its other sides very long, but even to measure a base of a few hundred yards in this way accurately is not at all easy. It must be done so accurately that it is not out by even a few inches, and it takes a day to measure a short distance like 250 feet. The rule itself must be made so that the weather cannot affect its length; and the rule generally used is made of two lengths of metal, one of iron and the other brass, fastened in the middle and so adjusted that any variation in length caused by heat or cold is clearly noticeable.


A net of triangles.

In measuring the size of a country and making maps, the surveyors measure carefully a few triangles and then calculate triangle after triangle until the whole face of the country is covered. Each side of a triangle as it is computed is used as the base of another triangle, and so on. These measurements are very accurate. For example, once a line was calculated by trigonometry as 36,574 feet and 4 inches. When actually measured by a chain, the result differed by one inch only.

HOW DID MEN FIND OUT THE EARTH'S CIRCUMFERENCE?

It is the practice in measuring parts of a circle to divide the circle into 360 equal sections called degrees. There is no reason why it should be 360, any more than, say, 240 or 400; all that is required is a number that can be divided by four, because it is convenient in measuring a circle to work on a quarter of the circle. It is obvious that if we divide the circumference of the earth into 360 equal parts, and we measure one part, we have only to multiply that measurement by 360 in order to determine the circumference of the earth.

We must first of all know where the Equator is, the midway line between the Poles. This is found easily by means of an instrument called a theodolite fitted with a telescope, which enable us to find the exact angle made by two imaginary lines, one passing from our eye to the horizon and the other from our eye to the Pole Star. This angle is called the altitude of the Pole Star. At the North Pole the Pole Star is immediately overhead, but as we travel from the Pole toward the Equator we have to look more and more slantingly at the Pole Star, till at the Equator it appears on the horizon. Its altitude is then said to be 0 degrees.

Now, to measure a degree on the earth's surface we find the altitude of the Pole Star by means of the theodolite. Perhaps we select a place where the altitude is 40°. If we travel along the same meridian till we come to a place where the altitude is 41°, we know we have traveled over one degree. We can now measure this by a system of triangles, and it is found that the degree is 69 miles. Multiplying 69 by 360 we have 24,840 miles as the circumference of the earth.

DOES A ROUGHENED SURFACE IMPROVE A GOLF BALL?

The first golf balls were not rough, but it was found by experiment that if a golf ball is made rough it flies farther and straighter than if it is perfectly smooth. Why this should be so is difficult to explain. Probably the roughened ball has more elasticity when struck by the club. It seems certain, too, that the roughening of the ball makes it revolve like a rifle bullet, thus giving it a straighter path.

CAN A SPIDER'S WEB BE MADE INTO CLOTH?

Yes. There used to be a little factory at Languedoc, in France, where spiders were reared for their webs, which were spun into gloves and stockings. It failed, however, because of the very great expense of rearing the spiders. They are much more difficult to keep than silkworms, as they fight fiercely and eat one another unless kept in isolated pens. They are so active, too, that they need a great deal of room, and all this means increased expenditure for rent and labor. Every spider has to be fed separately and the yield of web is not enough to repay the outlay. To harvest the web is a much more elaborate and lengthy business than winding off the cocoon of a silkworm. The web is much finer than silk, being often only a thirty-thousandth of an inch in diameter.

About a century ago there was a good deal of experimenting to find some economical way of winding off the web from spiders. In 1830 the Society of Arts presented its silver medal to Mr. Daniel Rolt for having invented a winding spool attached to a little engine which in two hours wound off 18,000 feet of web from 24 spiders.

There is always a demand for spider's web by makers of surveying instruments, the web being used for the hair lines across the glasses of theodolites.

WHY SHOULD WE KNOW THE NAME OF BELISARIUS?

Belisarius, whose name means "White Prince," was a famous Roman general living in the sixth century. He served under the emperor Justinian in Constantinople, and by his great victories revived the fame of the Eastern Empire. He repulsed the invading Persians at different times, took Carthage, overthrew the king of the dreaded Vandals, and did so much for his country that he was granted a triumph—a ceremony that no commoner had been honored with for four hundred years.

But when he failed to raise the siege of Rome, he ceased to be in favor at the ungrateful court. Soon after, when a conspiracy against Justinian was discovered, Belisarius was accused of being the promoter of the plot, was deprived of his wealth, and went into hiding. From that time our knowledge of his life is uncertain. Some historians say he remained imprisoned in his palace for a year and was restored to his titles before he died. Others say that his eyes were put out, and he spent the last two years of his life begging in the streets of Constantinople. Probably it is the second of these stories that is legendary.

But, however uncertain his end, we know that his career had a considerable influence on our civilization. He preserved from barbarians the Byzantine treasures in art and letters, treasures that inspired the men of the Italian Renaissance and, indeed, the whole of Europe.

WHEN WERE MADRIGALS COMPOSED AND SUNG?

The brave days of Elizabeth, famous for the exploits of great sea captains and for countless doughty deeds on land and sea, are not less famous for the great captains of literature who lived then. They should be equally famous for the great composers whose music is once more being heard in England after centuries of neglect.

William Byrd was one of these. He was born in 1543 and died in 1623. He was the Father of the English school of madrigal-composers. This particular style of writing flourished in Italy before it was known in England. When English composers began to make music in this fashion they quickly became masters of the art, and produced a great quantity of most beautiful music written in this style. It has never been excelled from that day to this, even by the Italians, who first of all wrote this particular kind of music.

Many people at first find it difficult to enjoy this Elizabethan music. We have been accustomed to listen to *one* tune, which is usually at the top, but with the music of William Byrd and the other Elizabethan composers we have to listen to several melodies, often with contrasting rhythms, but so written that they combine together satisfactorily. Putting it in another way, we are used to *one* point of interest, the tune and the harmony; but with the Elizabethans we find several points of equal interest. Each part or voice is a melody, and to enjoy it we must be able to follow, not *one* tune and its harmonization, but three or four or five melodies, proceeding together and yet independently.

Thus, if we say that our usual way of listening is vertical—the tune and the harmony which lies beneath it—then to enjoy Byrd's music we must listen horizontally—we must follow the course of each melody, and, at the same time, appreciate the effect gained by the combining of the melodies. This horizontal listening is not easy at first, but if we only hear enough of this fine English music we appreciate it fully.

The composers of the English madrigal school wrote in all styles. There were gay, quaint little songs like the one by Weelkes telling of Robin Hood, Maid Marion and Little John. There were bright, happy ones such as Morley's Now is the Month of Maying, but most of Byrd's were songs of a rather serious type.

WHAT ARE WILLIAM BYRD'S EIGHT REASONS FOR SINGING?

At the beginning of the first music published by William Byrd that famous composer gave eight "reasons briefly set down to perswade every one to learne to sing." These are his eight reasons.

1. First it is a knowledge easily taught, and quickly learned where there is a good Master, and an apt Scoller.
2. The exercise of singing is delightfull to Nature and good to preserve the health of man.
3. It doth strengthen all the parts of the brest and doth open the pipes.
4. It is a singular good remedie for a stutting and stammering in the speech.
5. It is the best meanes to procure a perfect pronunciation and to make a good Orator.
6. It is the onely way to knowe where Nature hath bestowed the benefit of a good Voyce, which guift is so rare as there is not one among a thousand that hath it; and in many that excellent guift is lost because they want Art to expresse Nature.
7. There is not any Musicke of Instruments whatsoever comparable to that which is made of the voyces of men, where the voyces are good, and the same well sorted and ordered.
8. The better the voyce is, the meeter it is to honour and serve God therewith; and the voyce of man is chiefly to be imployed to that ende.

Since singing is so good a thing
I wish all men would learne to sing.

In the time of Byrd, who lived over three hundred years ago, there were comparatively few people who could not read music at sight, and it was expected that all should be able to take their part in the madrigals which it was the custom to sing when supper was ended.

WHY IS THE WORLD LIGHT WHEN THE SUN IS BEHIND CLOUDS?

If the moon passes directly between us and the sun, the earth becomes dull and gloomy because the moon is quite opaque, which means that no light can pass through it. But, when there are only clouds between us and the sun, a good deal of light always gets through them, so long as they are real, clean, water clouds. Robert Browning says:

> A Sun will pierce
> The thickest cloud Earth ever stretched.

Sometimes in great cities we make unnatural clouds, filled with smoke and dirt —mostly specks of coal which we have sent up the chimney. These are the really dark clouds, full of solid black dirt, and there are times when they make the faces of cities darker in the daytime than they usually are during a summer night. Coal was made by the sunlight of past ages, and we send it into the air to stop the sunlight that has traveled such a long way from the sun to serve us. It has 93,000,000 miles to come, and just at the last half-mile or so we stop it. A very stupid thing that is—especially as we actually use past sunlight to stop it with.

WHERE DOES THE LIGHTNING GO WHEN IT REACHES THE GROUND?

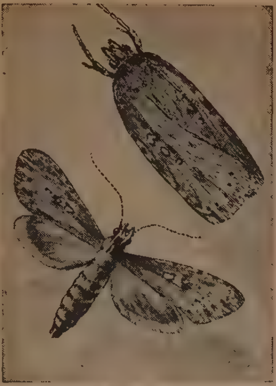
The lightning is the light caused by the passage of an electric current. It is only a momentary consequence of the passage of the electricity; and when the electricity has passed the lightning-flash ceases, for there is nothing to make it flash any more. It is not the lightning that reaches the ground, but the electricity; and this passes into the earth and causes changes which we are only beginning slowly to understand. It is changed when it enters the earth, and its energy is used up in certain chemical changes in the soil.

WHY DOES A TREE GROW STRAIGHT, AS A RULE?

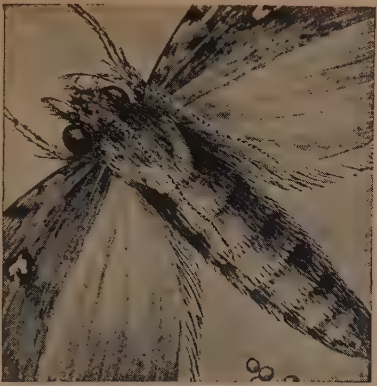
A steady wind usually blowing from one direction may bend a tree. Or if a tree grows near a wall, so that the light strikes it unequally on the two sides, it may grow crooked. But a tree usually grows straight, because that is the best way for it to grow, and because everything helps it to do so. There is much less strain on its roots if it grows straight, and its roots spread about equally in all directions through the ground, and so help to keep it in that position. Also, a tree throws out branches about equally on all sides, so that their weight all round helps to balance it and keep it straight.

Trees that are able to grow straight

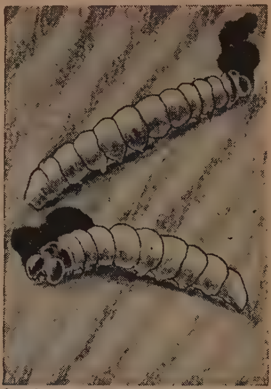
THE LIFE-STORY OF THE CLOTHES MOTH



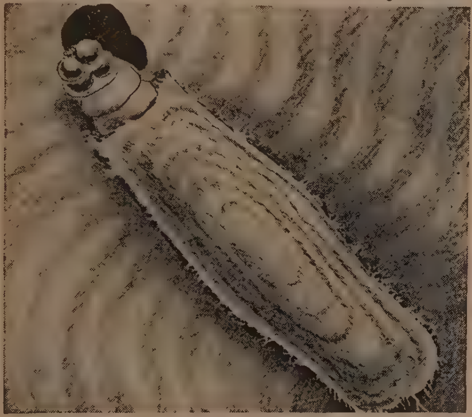
1. The larvæ of several moths prey on our clothes, but the commonest is that of a yellowish moth measuring half an inch across the wings. It is seen flying in summer.



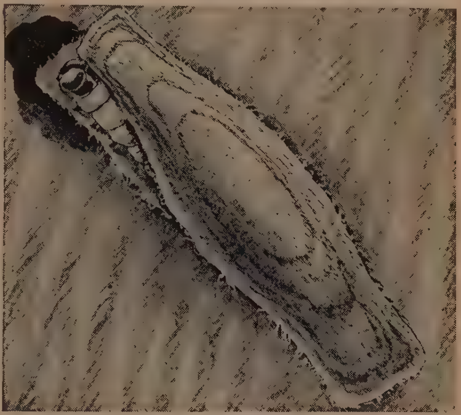
2. The moth's jaws are quite unsuited to eating, and its only business is to lay eggs. The eggs are very tiny, and are laid on fur or cloth which will provide a sure supply of food for the grubs when they hatch out.



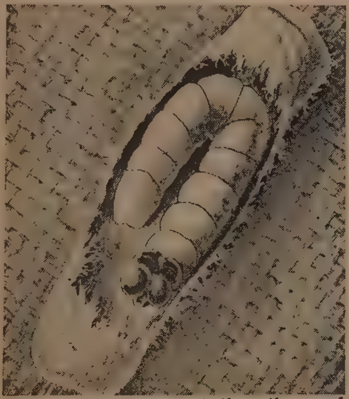
3. As soon as the grubs are hatched they begin with their scissor-like jaws to cut off pieces of the fur or cloth, partly for food and partly to make clothes for themselves.



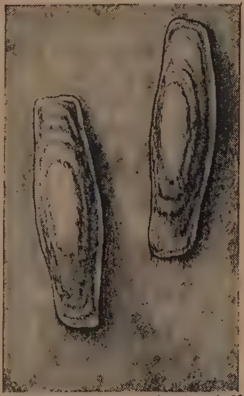
4. With the cut fur the grub, or larva, makes a cylindrical case, and lines it with silk. When it wants to eat or travel it puts out its head and, holding on to the inside of the case with claspers, draws the case after it.



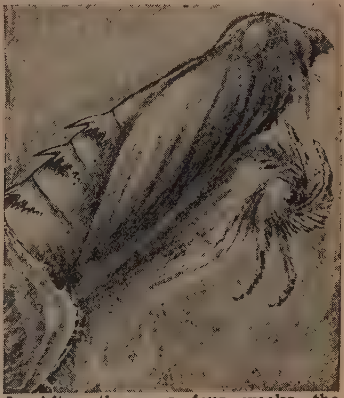
5. As it grows the larva must enlarge its case, and this it does by making a slit along each side with its scissor-jaws and inserting a fresh length of material. It enlarges one end completely before starting on the other.



6. In order to get at the other end of the case, after it has enlarged one end, it turns right round inside, as shown here. In addition to enlarging the circumference it also increases the length as required.



7. As soon as it is full grown it is ready to change into a chrysalis. For safety's sake it anchors its case somewhere with strong silk threads.



8. After three or four weeks the chrysalis, by means of little spines on its back, works its way out of the case. Then the moth bursts out, and as soon as its wings have expanded, flies off to find a mate.

upward are most likely to thrive, because growing straight means that there will be space for branches with their leaves on all sides, and the tree can use more sunlight and is better fed. Some of the reasons why trees generally grow straight are what we may call mechanical reasons, like those about the balance of the branches. Others are deeper reasons, depending on the way the tree lives, and the manner in which, like every living creature, it tries to adapt itself to the conditions of its life so as to live as well as possible.

WHAT IS THE WIND LIKE ON A MOUNTAIN-TOP?

On the top of high mountains a southwest wind or a northwest wind almost always blows, except at, or very near, the Equator. On the top of the Rocky Mountains, or Pike's Peak, or the Peak of Teneriffe, there is always a strong southwesterly wind blowing.

The reason for this is plain. The hot currents of air in the tropics, ascending high, flow toward the north. The old polar winds flow in from the north to take their place. When we climb a high hill we get into these currents of hot air going northward. But these currents have come from the tropics, where they have been carried eastward very fast by the rotating surface of the earth. This eastward motion they still retain as they flow northward. As in the tropics they were being carried round in a *big* circle, their rate of motion is quicker than the rate of motion of the air farther north, which rotates on a smaller circle of the earth. So they rush eastward past the high mountains as if they were winds blowing from the southwest.

Similar reasoning shows that on a mountain-top in the southern hemisphere the wind would blow from the northwest.

All the air naturally goes round eastward with the rotating earth. The air nearer the Equator goes round in a bigger circle, and therefore goes eastward faster than the air near the Poles. It is this faster air, on its northward or southward journey, that we meet on the top of the hills and feel as a southwest or a northwest wind.

CAN GRAVITATION PULL A CLOUD DOWN?

Gravitation does pull the clouds down. Clouds consist of drops of water usually condensed on particles of dust. The drops are heavier than the gases of the air, so that under the pull of gravity they must fall through the air. But though the separate drops of water in a cloud are falling, the cloud often seems to float, simply because water-vapor, which is lighter than the other gases of the air, is constantly rising, expanding, cooling and condensing into new raindrops which take the place of those which are falling. The falling drops, as they fall into the denser and warmer air, evaporate and become vapor again. In that way the cloud seems to keep its form and position, even while it is raining itself away.

At the same time the fine water-drops may be held up by the force of an ascending warm current of air which rises with the warm water-vapor. Or they may be blown upward on a wind forced up by the slope of a mountain. If such a wind be cold and damp, it will not only force the drops of the cloud upward but, as it expands, will add to their number from its own supply of moisture.

But gravity is pulling all the time, and there never yet was a drop of water in the sky that did not eventually fall as rain on the earth.

WHAT MAKES THE FIRE CHANGE COLOR?

The fire changes color partly because of variations in its air supply and partly because of the escape of different gases from the coal. The burning is due to the oxygen, and the more oxygen supplied, the more brightly and rapidly will the fire burn.

It must be remembered that different substances and gases have their own colors when burning. Coal contains, besides carbon, various mineral substances and several gases, all of which affect the color of the fire in some way. The flames from different woods also show differences in color. You have already learned that makers of fireworks can produce many colors at will by using different chemicals.

DOES EVERYTHING IN THE AIR MOVE WITH THE EARTH?

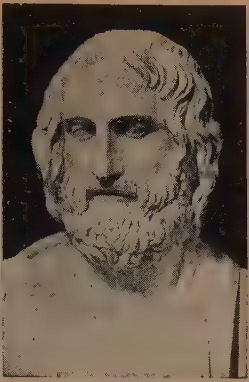
Certainly. The air goes round with the earth, as the seas do, and everything that is swimming in them. Everything in the air shares its movement and moves with it, except in so far as it has some power of movement of its own, like an airship or a bird.

THE NEXT WONDER QUESTIONS ARE ON PAGE 5839

Æschylus.

Herodotus.

Sophocles.


Euripides.

Thucydides.

Aristophanes.

THE LITERATURE OF GREECE

ONE night in London, more than a hundred years ago, a young and delicate man sat up into the small hours of the morning reading a book which he had never seen before.

The spell cast on his senses by this book was still over his mind as he hurried to his home through the dawn-lit streets of the slumbering city, and before he lay down to rest he wrote a sonnet expressing the nature of this spell:

Then felt I like some watcher of the skies
  When a new planet swims into his ken;
Or like stout Cortez when with eagle eyes
  He stared at the Pacific—and all his men
Looked at each other with a wild surmise—
  Silent, upon a peak in Darien.

So ends the immortal sonnet written by the boy John Keats on reading for the first time Chapman's translation of Homer. Homer's mighty line had carried him high into undiscovered heavens, and had set his feet on a peak of imagination from which he gazed in silence across an infinite ocean hitherto unknown.

Who was this Homer? Long before Jesus was born in Palestine the lines of Homer rang deep music in the minds of Greek people—shepherds, field laborers and tent-makers—and even now they are the noblest music in the world to hundreds of European scholars. A strange poet to cast so marvelous, so universal, a spell upon the soul of man. How eagerly we desire to read his story. Alas, there is no story to tell! The libraries of the world are full of books about Homer, but if we were to read all those books through from beginning to end we should still be no wiser about the man we call Homer. The most we can say about him is this:

Long before the dawn of history or the birth of science, and long before man invented the art of writing, someone living in the country which we call Greece began to chant the legends of his country. From father to son these tales were handed down. They formed the nation's unwritten Bible. They were what is called a saga. Every boy who desired to know the past of his nation and the history of the world before his time listened to this great strain. It came down the ages, changing here and there on its long journey, but preserving always its majestic splendor and its incomparable simplicity, so that every child knew it by heart, and every youth set himself to become as strong, as brave, as true and as gentle as the great heroes of his nation's past.

But the time did arrive when someone wrote these poems down, and we have his Iliad describing the siege of Troy, and his Odyssey telling of the wanderings of Ulysses. We can see how long a time this must have been after the real Homer lived, because he makes Homer speak of all the poetry that was in the world before his time and how difficult it is to find a theme that is not worn threadbare. And not only this: the scribe puts the poems into hexameters, a metre which comes late in the development of poetry, whereas the original saga was probably in short and simple lines. But even so, the Homer who wrote down these poems is lost to us in the mists of far ancient times.

THE MYSTERY WHICH SURROUNDS THE LIFE OF HOMER

The very name of Homer is a mystery and a difficulty. It simply means "hostage." Was he the son of a hostage, and therefore not allowed to fight in battle, which was regarded as a true man's life, but made to earn his bread in the womanly or domestic task of minstrelsy? Did he live in Chios or Smyrna? No one can tell. He is said to have been blind: but why? "We have here," says Professor Gilbert Murray, "some vague memory of a primitive time when the able-bodied men were all warriors; the lame but strong men, smiths and weapon-makers; and the blind, good for nothing else, mere singers." In all this we can see the work of a most ancient saga.

But for us, like Keats, the magic of Homer is his poetry. He tells us of days before history. He brings before us in living form men and women of a most ancient legend. In reading of the siege of Troy or the long wanderings of Ulysses we are reading the greatest and the grandest fairy tale in the world.

THE EARNEST POET WHO KNEW THE SADDER SIDE OF LIFE

Homer tells us this fairy tale, not with any air of patronage, like that which some grown-ups use in telling fairy stories to very little children, but as if he himself believed every word to be true, and as if indeed all the strange and terrible creatures in his poems really did exist in those far-off times.

He is in earnest: he is seldom amused. The sorrows of mankind press on his heart. The beauty of nature is filled for him with a certain mysterious sadness. He is religious and noble. Not once in all his pages does he ever blame his country's enemies. He sees everything—the rosy fingers of the dawn and the fear in the eyes of Hector's baby son at the sight of his father's plumed helmet. He describes what he sees in matchless language. In knowledge of the human heart he is surpassed only by the greatest of all the poets of mankind—Shakespeare. And he lived in days of which we have no sure count.

This marvel of Homer is one of the things we must graft on our understanding. In reading of Greek literature we are reading of the most wonderful men that ever lived—discoverers and inventors, men who took much from the past, but formed new minds by their passionate desire to find truth. We may see what the Greeks have done for us by merely looking round our own libraries and our own streets.

GOETHE'S HIGH OPINION OF THE LITERATURE OF GREECE

In every library you will find books of *philosophy*. The word, and the thing itself, is Greek. And you will find there books of *biography, poetry, lyrics, dramas, epics, rhetoric, logic, history, mathematics, astronomy* and *epigrams*. In the streets you will find *theatres*, and in the theatres you will find *orchestras*, and the plays will be *tragedies* or *comedies*, composed of *characters* who speak in *dialogue*, with *scenery* to help them, and perhaps with *music* to accompany them, and if the play is a musical comedy it will have *melodies* and a *chorus*. All the words in italics come to us from the Greeks. The Greek gave Europe the form of its culture.

As late as Goethe's day our debt to the Greeks was acknowledged in a phrase which haunts the mind. He said: "Beside the great Attic poets, like Æschylus and Sophocles, I am absolutely nothing." And he told us, this greatest of all the moderns, in what manner Greek literature is distinguished above all others: "It is marked by grandeur, excellence, sanity, complete humanity, a high philosophy of life, a lofty way of thinking, a powerful intuition."

We may see something of this sanity in the earliest parodies of which we have any record. They were parodies of Homer, and have been ascribed even to Homer himself. Evidently some clever and deep-thinking Greek, perhaps a cripple or a blind man, realized the folly of war, resented the importance given to the warrior, and desired to turn men's minds away from Hector and Ajax, Ulysses and Menelaus, to thoughts and ideas less dangerous to the peace of the world and the happiness of the human heart. Thus we get The Battle of the Frogs and Mice.

We take the following short extract, and many other passages, from a great Greek scholar, Professor Gilbert Murray:

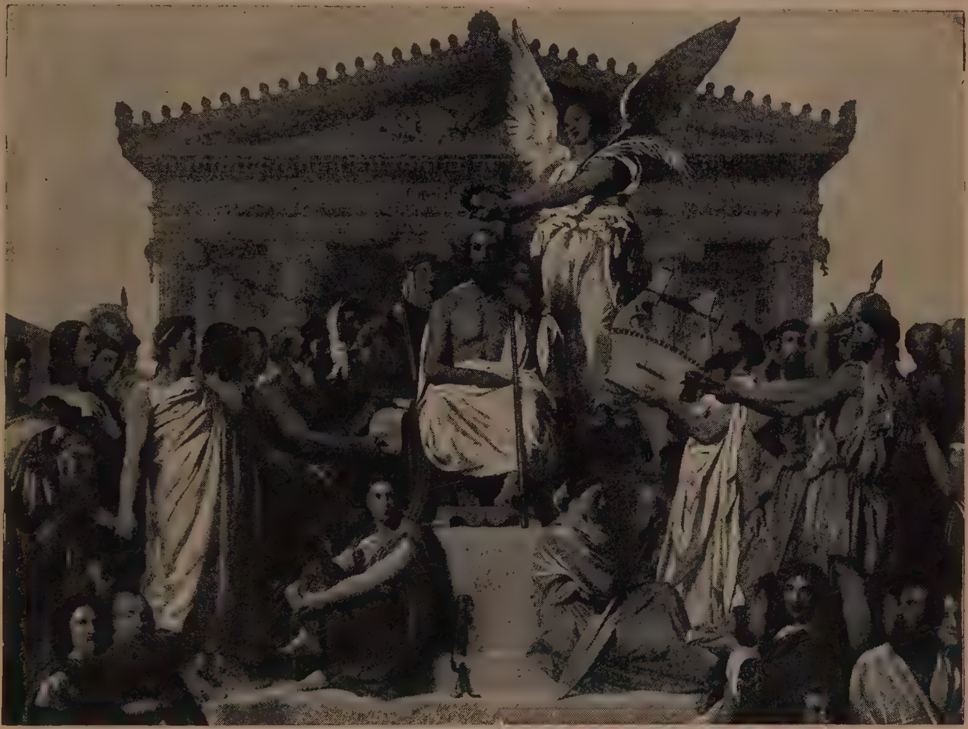
The battle began because a mouse . . . flying from a weasel, came to a pond to quench his thirst. He was accosted by a frog of royal race . . . who persuaded him to have a ride on his back and see his kingdom. Unhappily . . . some otter-like animal lifted its head above the water and the frog instinctively dived. The mouse perished, but not unavenged. A kinsman saw him from the bank, and from the blood-feud arose a great war, in which the mice had the best of it. At last Athena besought Zeus to prevent the annihilation of the frogs. He tried first thunderbolts and then crabs, which latter were more than the mice could stand; they turned and the war ended.

The author shows from what little causes great wars arise.

THE WRITERS OF OLD GREECE RIDICULED THE IDEA OF WAR

Thus did the wise parodist endeavor to make men see that all their grand wars, which were supposed to interest the gods, had their origin in absurdity. Other comic pieces were called A Spider Fight, A Crane Fight, and there is a poem about Fieldfares. There is also a comic poem about a mock hero of whom it is said: "Many arts he knew, and he knew them all badly"; and, "He was not meant by the gods for a digger or a plowman, nor generally for anything sensible; he was deficient in all manner of wisdom." Thus early in their astounding history did the Greeks perceive the danger of the warlike epic, and so proceeded to make fun even of the noblest of their possessions, the great Homeric saga. Truly an astonishing and most gifted people.

Early, too, in their history comes Hesiod, who lived in a village on the side of Mount Helicon, the climate of which he describes very neatly in the phrase, "bad in winter, insufferable in summer." He, too, like the comic poets, wanted to make men think of useful things, and so he turned from war and romance to show



The World's Poets Pay Homage to Homer—From the painting by Jean Ingres.

the virtue of industry. "Hard work is no shame," said he; "the shame is idleness."

Professor Gilbert Murray thinks that Hesiod represents the peasant's wisdom, and that his works are a collection of a very old peasant poetry in Bœotia. Some of his sayings live to this day:

> Help your neighbor, and he will help you.
>
> A neighbor matters more than a kinsman.
>
> Take fair measure, and give a little over the measure—if you can.
>
> Give willingly; a willing gift is a pleasure.
>
> Give is a good girl, and Snatch is a bad girl, a bringer of death!

THE INTIMATE SIMPLICITY AND CHARM OF GREEK WRITING

Listen to his description of a certain month in the year:

> . . . bad days, enough to flay an ox, when the north wind rides down from Thrace and earth and the plants shut themselves up; and he falls on the forest and brings down great oaks and pines; and all the wood groans, and the wild beasts shiver and put their tails between their legs. Their hides are thick with fur, but the cold blows through them, and through the bull's hide and the goat's thick hair; but it cannot blow through to the gentle little girl who sits in the cottage with her mother.

Sappho, the great singer of personal melodies, has this same note of observation, this same feeling for nature: "Like the one sweet apple very red, up high on the highest bough, that the apple-gatherers have forgotten; no, not forgotten, but could never reach so far."

Writing of this character brings home to us one of the great charms of Greek literature—its intimate simplicity. "You Greeks," said an Egyptian to Solon, "are always children." It is true, but in the highest sense. About Greek literature there is a freshness which is like a spring dawn and an innocence which is as beautiful as dew. With them we are always on the mountain-top or in sight of the glittering sea, never in a physician's consulting-room or a coroner's court.

THE GOD OF THE COUNTRYSIDE IS SPOILED AND DEGRADED

Greek religion, in its earliest simplicity, helps us to understand the poetry of this extraordinary people. Bacchus, when the Greeks first conceived him as Dionysus, and not as he was afterward degraded by the Romans, was a lovely god of ecstasy who lived in the woods and haunted trees. He represents that mysterious force in human nature which we recognize to be higher than reason—impulse, intuition, and the inspiration which, as Wordsworth felt, flashes into the soul the certainty of its divine origin. "Dionysus," says Professor Murray, "is the god within, the spirit of worship and inexplicable joy: he appears best in communion with pure souls and the wild things of nature in the solitary mountains under the stars." Dionysus suffered degradation in the course of time, but he shows us that the Greeks were conscious of that inwardness of religion which in its latest and more sober form, and under the exquisite influence of Christianity, is known to us in the Society of Friends.

Some six hundred years before the birth of Jesus certain of the Greeks turned away from religious rites and began that investigation of natural laws which, after Aristotle, was destined to give the modern mind its greatest occupation—physical science. But while the few turned their backs on religion, regarding it as an idle superstition, the many plunged deeper and deeper into the mystical rites connected with Orphic worship. Then came the great duel between the few and the many which at last produced for Greece a victory of the human reason, from which all ages ever since have derived their greatest benefit.

XENOPHANES INFLUENCED FOREVER THE CURRENT OF MAN'S THOUGHTS

Xenophanes, who lived about 550 B.C., told the Greeks that Homer and Hesiod had fastened on the gods all that is a shame and a rebuke to man. "Men have made God in their own image," he declared; "if oxen and lions could paint, they would make gods like oxen and lions." He traveled up and down Greece tossing, as he himself put it, his troubled thoughts among the people, always telling them that "there is one God most high over men and gods," and declaring of this Supreme Power that "all of him sees, thinks and hears; he has no parts; he is not man-like either in man or body." It was a bold thing to challenge the authority of Homer and Hesiod; perhaps a bolder thing still to denounce the priests as hypocritical and ignorant. Xenophanes had his reward: he influenced forever the current of man's thoughts.

This is not the place to write about Greek philosophy, and in the Book of

Men and Women we may read about the work of Socrates, Plato, Aristotle and Epictetus; but even here, in dealing with Greek literature pure and simple, we shall find the influence of Xenophanes and all the first bold thinkers and undaunted explorers of Hellas.

Simonides, whose epigrams are delightful, was born in 556 B.C. He was a man of wide culture, a great traveler, a wit, a skeptic and a penetrating thinker. "His sayings were treasured, and his poems studied with a verbal precision which suggests something like idolatry."

THE EPIGRAMS OF SIMONIDES HAVE LIVED THROUGH THE CENTURIES

His epitaph for those who fell at Thermopylæ is still the most perfect thing of its kind: "Stranger, bear word to the Spartans that we lie here obedient to their charge." A base man and a bad poet named Timocreon ventured to attack him. Simonides replied with an epitaph: "Here lies Timocreon of Rhodes, who ate much, drank much, and said many evil things." Notice the passionless, effortless simplicity of this epitaph, and its calm disdain in making no mention of Timocreon's attempts to write poetry.

But Simonides, who has been likened to Voltaire, and is curiously modern, was disliked by the greatest of all the poets of that time, and one of the greatest in the world even now, Pindar. The English poet Gray wrote of the pride and ample pinion.

> That the Theban eagle bear,
> Sailing with supreme dominion
> Thro' the azure deep of air.

Pindar was too much of a poet to take sides with any school or to welcome any spirit so dangerous to art as skepticism. But even in his poetry we may detect the spirit of the age, for he gives to Zeus a full spiritual supremacy, and will not admit that he can be deceived or tricked, as Homer had taught.

THE TREASURED WORKS OF HERODOTUS, THE FATHER OF HISTORY

In this same age history was born, and to this day the works of Herodotus, the "father of history," remain a treasured possession of educated people. He traveled about the world listening and inquiring, and then returned to tell what he had heard and seen, going up and down Greece with his stories. Thucydides, who came later and was a greater man, despised Herodotus because, he said, Herodotus did not seek truth, but tried only to amuse. He was no critic, merely a tale-teller. All the same, Herodotus guided the human mind into a new channel. We see the influence of his age on him when we read: "About the gods one man knows as much as another." Of the Persians—his country's hated enemies—he says, in Professor Murray's translation:

> Images and temples and altars it is not in their law to set up—nay, they count them fools who make such, as I judge, because they do not hold the gods to be man-shaped, as the Greeks do. Their habit is to sacrifice to Zeus, going up to the tops of the highest mountains, holding all the round of the sky to be Zeus.

THE EXILE WHO REFUSED TO BELIEVE IN THE GODS OF OLD GREECE

As to the Persians themselves, "he takes evident pleasure," says Professor Murray, "in testifying not only to their courage, but to their chivalry, truthfulness and high political organization." All this is splendid, and even noble, but the great Age of Pericles was now dawning on the ancient world.

Thucydides, the great historian of the Peloponnesian War, was a soldier who had been exiled by Athens. He did not believe in the interference of the gods. He brushes religion aside. "He cares for great movements and organized forces. He believes, above all things, in reason, brain-power and intelligence." Of his old age Professor Murray has this fine passage in his book Ancient Greek Literature:

> His life is over now, without distinction, his Athens ruined beyond recognition, the old mistress of his love dead and buried. But he keeps firm the memory of his real city and his leader—the man whom they called a demagogue because he was too great for them to understand; who never took a gift from any man; who dwelt in austere supremacy; who, if he had only lived, or his counsels been followed, would have saved and realized the great Athens that was now gone from the earth.

WHY GREEK LITERATURE BELONGS TO ALL THE WORLD

He sits down in this spirit to write his history, wherein Pericles lives forevermore; but he dies ere it is finished, and it is not until the reign of Augustus Cæsar that his mighty book is recognized as the noblest of all ancient histories.

But for most men Greek literature is not Greek history, but Greek poetry.

Even the most beautiful work of Plato and the epoch-making work of Aristotle may be claimed to belong to all philosophy and all science rather than to the literature which is essentially Greece. And outside of Homer, Greek poetry means the dramatic poems of Æschylus, Sophocles and Euripides, and of the comic writer Aristophanes, whose smile promises relief from too much tragedy.

Æschylus, the father of Greek tragedy, composed the tremendous drama Prometheus Bound. He was an aristocrat who had fought at Marathon, and was among the Greeks who took to the ships and sailed for Salamis. He lived from 525 to 456 B.C. He had seen terrible things, and his plays are full of sadness and sorrow. "There is a cry in the waves of the sea as they fall together, and groaning in the deep; a wail comes up from the cavern realm of Death, and the springs of the holy rivers sob with anguish." And not only Nature suffers, but Man. The glory which shines round about a conqueror has no attraction for this soldier of Marathon. He likes a conquering king no better than he likes a political despot. One passion alone fills him with fire—the passion for human freedom. Of only one conqueror can he bring himself to speak—God, whose will is everywhere, from whose justice no man escapes. God, he says, made for Man the road to thought, and established one abiding law: Learn by suffering.

THE HANDSOME POET WHO HAD THE TRUE SPIRIT OF THE ARTIST

Sophocles was an altogether different man. He lived his whole life (from 496 to 406 B.C.) in the sun of Athenian glory, loved by everybody. Rich, handsome, amusing, light-hearted, ready to dabble in politics and to take a shining part in the national life, he was not much good to his fellow-men, except as a poet.

As a poet he was one of the greatest men in the world. He thought Æschylus was too grand and sonorous. He aimed at a certain severity of form, like Greek architecture, and then proceeded to ease and naturalness. He was forever working in the spirit of a true artist, striving after perfection and knowing that form is an essential part of excellence. His Antigone is said by Professor Murray to be "perhaps the most celebrated drama in Greek literature." It is the tragic idea of useless martyrdom—"the devotion to a higher unseen law, resulting in revolt against, and destruction by, the lower visible law." It has been very well translated, and should certainly be read by all who wish to acquire a knowledge of Greek tragedy. To give us some notion of Sophoclean writing Professor Murray translates the following beautiful lines addressed by Œdipus to Theseus:

Fair Aigeus' son, only to gods in heaven
Comes no old age nor death of anything;
All else is turmoiled by our master Time.
The earth's strength fades and manhood's glory fades,
Faith dies, and unfaith blossoms like a flower.
And who shall find in the open streets of men
Or secret places of his own heart's love
One wind blow true forever?

THE SHELTERED LIFE OF THE GREEK WHO FIRST COLLECTED A LIBRARY

When we come to Euripides we find ourselves in the presence of a strange and disturbing figure. He was born in 480 B.C., lived on a small estate in Salamis, shunned public life, avoided the society of his fellow-men, collected a library of books—he was the first Greek to do so—and wrote in a gloomy cave that faced the sea. He died in 406.

He had begun life as a patriot and had fought for his country, but thought forced him away from all confident sentiments and confronted him with the sorrow and suffering of mankind. One of his plays begins with "a great fleet sailing triumphantly to sea, unconscious of the shadow of blood-guiltiness that rests upon it, and the gods who plot its destruction as it goes." He hated bloodshed and regarded war as a crime. But he went even further, or deeper, than this. In the eighteenth century men thought that they had only to be rid of kings to end war, and of priests to be rid of servitude. But Euripides knew what we only now begin to know: that republics can be as warlike as any despot, and a majority as tyrannical as any domineering priesthood.

HOW EURIPIDES DESPISED THE SOCIAL SYSTEM OF HIS DAY

Another motive which was always present in him, and now becomes predominant, is a certain mistrust of the state and all its ways—the doctrine explicitly preached to the present generation by Tolstoi. The curse of life is its political and social complication. The free individual may do great wrongs, but he has a heart somewhere; it is only the servant of his country, the tool of the "compact majority," who cannot afford one.

But the face of Euripides brightened

when he turned away from the dark world to look into the fairy realm of imagination. His Andromache is one of the most beautiful plays in the world, full of the pure loveliness of a noble mind and shining with the grace of a gentle heart. Professor Murray has translated many of his great tragedies, and they may be read with pleasure by those who know little or nothing of Greek history.

We give you an extract from one of these, Jason and Medea, the story of which you know from the tale of the Golden Fleece. Medea loved Jason and left her country to accompany him. Later he wearied of her and sought another, younger bride and banished Medea and her children. At first Medea stormed, then gathered herself together and determined upon revenge. Pretending to be reconciled to Jason's plan, she sent the young bride gifts, to persuade her to allow the children to stay. Jason innocently urged the young bride to accept these.

Soon as she saw the ornaments, no longer she held out, but yielded to her lord in all; and ere the father and his sons were far from the palace gone, she took the broidered robe and put it on, and set the golden crown about her tresses, arranging her hair at her bright mirror, with many a happy smile at her breathless counterfeit. Then rising from her seat she passed across the chamber, tripping lightly on her fair white foot, exulting in the gift, with many a glance at her uplifted ankle. When lo! a scene of awful horror did ensue. In a moment she turned pale, reeled backwards, trembling in every limb, and sank upon a seat scarce soon enough to save herself from falling to the ground. An aged dame, one of her company, thinking belike it was a fit from Pan or some god sent, raised a cry of prayer, till from her mouth she saw the foam flakes issue, her eyeballs rolling in their sockets, and all the blood her face desert; then did she raise a loud scream far different from her former cry. Forthwith one handmaid rushed to her father's house, another to her new bridegroom to tell his bride's sad fate, and the whole house echoed with their running to and fro. By this time would a quick walker have made the turn in a course of six plethra and reached the goal, when she with one awful shriek awoke, poor sufferer, from her speechless trance and opened her closed eyes, for against her a twofold anguish was warring. The chaplet of gold about her head was sending forth a wondrous stream of ravening flame, while the fine raiment, the children's gift, was preying on the hapless maiden's fair white flesh; and she starts from her seat in a blaze and seeks to fly, shaking her hair and head this way and that, to cast the crown therefrom; but the gold held firm to its fastenings, and the flame, as she shook her locks, blazed forth the more with double fury. Then to the earth she sinks, by the cruel blow o'ercome, past all recognition now save to father's eye; for her eyes had lost their tranquil gaze, her face no more its natural look preserved, and from the crown of her head blood and fire in mingled stream ran down; and from her bones the flesh kept peeling off beneath the gnawing of those secret drugs, e'en as when the pine tree weeps its tears of pitch, a fearsome sight to see. And all were afraid to touch the corpse, for we were warned by what had chanced.

Aristophanes was a rich man who owned land, hated the rabble, and paid other people to produce his plays. Born in 450 B.C., he wrote at a certain careful distance from the life of his time, seeing it in a useful perspective, and finding very little in it to be taken seriously. Even the ragged Socrates amused him, and into a play goes the inspired teacher of Plato, caricatured, it is true, but a likeness that all could recognize. There was scarcely an idea of his time which Aristophanes did not consider exaggerated and a trifle absurd. On the whole his ridicule is good-tempered, while his wit remains a delight even to our own day. Perhaps the two plays which are most typical of his mind are The Clouds and The Frogs. He died in 385 B.C.

THE GENIUS OF THE ANCIENT GREEKS THAT SHOULD INSPIRE US ALL

From what we have written it will be seen that the Greeks were, of all people in the world, the most original; and that most of their literature is either sorrowful or tragic. This note of tragedy, or rather this strong insistence that human life is a sorrowful thing, does not weaken our admiration for their genius. Life was in those days a dark and tragic wretchedness. The poets saw this wretchedness and confronted it with the stern eyes of judgment. How could they call life a good thing when it was forever being dragged, broken, blood-stained, and bound at the chariot wheels of some monstrous tyrant; when war was the chief business of human existence, and religion had fallen into the base hands of a priesthood beneath contempt?

They did not know that their beautiful spirit and their brave thoughts would some day be woven into the teaching of Christ by the Apostle Paul, and through him would pass over the world and furnish a higher civilization for all mankind.

THE NEXT STORY OF LITERATURE IS ON PAGE 5907.

FRENCH—THE LOST KEY

First line, French; second line, English word; third line, as we say it in English.

Il est dix heures et demie.
It is ten hours and half.
It is half-past ten.

Quelqu'un frappe à la porte.
Someone knocks at the door.
Someone knocks at the door.

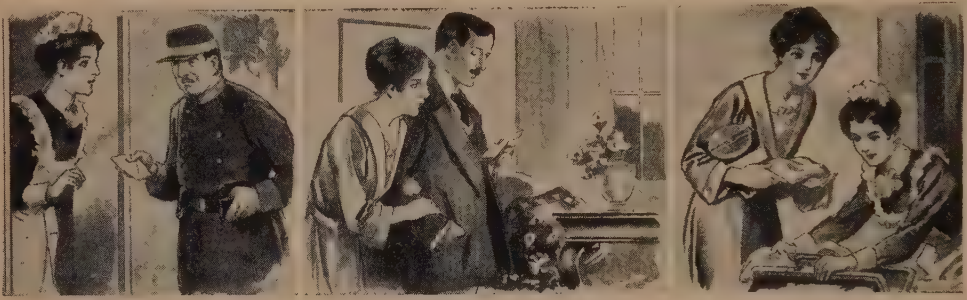
La bonne l'ouvre.
The maid it opens.
The maid opens it.

C'est le facteur.
This is the postman.
It is the postman.

Il a apporté un télégramme à papa.
He has brought a telegram to Papa.
He has brought Papa a telegram.

Papa le lit vite.
Papa it reads quickly.
Papa reads it quickly.

Papa dit qu'il doit aller à Londres pour affaires pendant quelque temps.
Papa says that he must to go to London for business during some time.
Papa says that he must go to London on business for a little while.



Maman et la bonne cherchent une valise.
Mamma and the nurse look for a bag.
Mamma and nurse look for a bag.

Elles la remplissent d'habits.
They it fill with clothes.
They fill it with clothes.

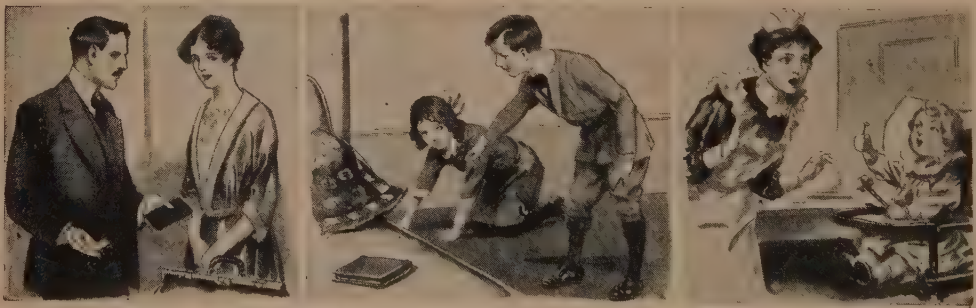
Elles ferment la valise et elles tournent la clef.
They shut the bag and they turn the key.
They shut the bag and turn the key.

Papa entre.
Papa enters.
Papa comes in.

Il veut mettre un livre dans la valise pour le lire en route.
He wishes to put a book into the bag for it to read in route.
He wants to put a book in his bag to read on the way.

"Où est la clef?" demande papa.
"Where is the key?" demands Papa.
"Where is the key?" asks Papa.

Nous ne pouvons pas la trouver.
We (not) are able not it to find.
We cannot find it.



Il faut qu'il arrive à temps pour le train, et il se fait tard.
It is necessary that he arrive at time for the train, and it itself makes late.
He must be in time for the train, and it is getting late.

Nous cherchons sur la table, sur le plancher, et sous le sofa.
We search on the table, on the floor, and under the sofa.
We search on the table, on the floor, and under the sofa.

Elle est perdue.
It is lost.
It is lost.

Puis la bonne crie: "Le vilain!"
Then the nurse cries: "The naughty one!"
Then nurse cries: "Naughty child!"

La clef est dans la bouche de Bébé!
The key is in the mouth of Baby!
The key is in Baby's mouth!

THE NEXT FRENCH STORY IS ON PAGE 5862.

STORIES SHAKESPEARE TOLD

THERE is both sorrow and joy in life. In our reading we should seek to vary the subject by choosing now tragedy and now comedy, and not always to read one sort of tale, as that would give us a wrong idea of life. As we saw in the story of Othello the unhappy ending of a hasty man's jealousy, we are now to see how the same folly may end not unhappily. A Winter's Tale, like A Midsummer Night's Dream, is a delightful piece of fancy and imagination; just the sort of story that we love to tell at a winter fireside. Measure for Measure is also a fine comedy that teaches us useful lessons of conduct. The charming comedy Much Ado about Nothing, like The Winter's Tale, shows how foolish it is to pay any attention to the tongues of slanderers. We change to tragedy with Romeo and Juliet. This is one of the saddest love stories in the world. Hamlet is also a tragedy. Many people think that this is Shakespeare's greatest play.

MEASURE FOR MEASURE

IN olden times there was a Duke of Vienna whose good-natured treatment of his people had not been to the advantage of his state. The laws of the city not being strictly enforced, as all laws should be, people stood in no fear of them. The Duke saw that for his people's good the laws would have to be kept. At the same time he did not wish to appear suddenly to change from a kind ruler into a tyrant. He had, therefore, to think of some way to carry out his reform without appearing to have lost his kindly interest in his subjects.

Among the noblemen of Vienna was one Angelo, a stern, severe and cold-hearted man. The Duke, thinking that Angelo would be just the man to enforce the laws, appointed him Lord Deputy, and gave out a report that he himself was leaving for a time to visit another country. Instead of going away, however, he assumed the habit of a monk and, thus disguised, remained in Vienna to see how Angelo conducted himself.

As chance would have it, the first case to call for Angelo's judgment was that of Claudio, a young gentleman who had secretly married a young lady named Juliet. In those days a bride had to bring her husband as a marriage dower a gift of money or land presented by her parents or relatives. Claudio and Juliet were keeping their marriage secret until it were known what fortune her relatives would fix for her dower. For this Claudio was condemned to death, a sentence which was an outrage. But Angelo, like all persons "drest in a little brief authority," was keen to exercise his new power. Claudio had a sister who, when this misfortune befell her brother, had but newly entered a convent. When news of the impending execution of her brother reached her, retiring and gentle though she was, she took courage to go forth and intercede with Angelo.

Although the Lord Deputy was a cold and cruel man, he was not insensible to the winning beauty of Isabella, as Claudio's sister was named. Her appeal seemed to soften him, but that was only because a selfish desire to possess the beautiful creature had been awakened in him. If she would consent to marry him, he promised to pardon her brother, thus being ready to add one injustice to another. The idea was horrible to a young lady who had just given up the thought of marriage. And of all men Angelo would have been the last she could have cared for. So she indignantly refused him. When she visited her brother in prison he, too, approved of her refusal. But as he thought of his impending doom his courage failed him and he begged her to submit.

The talk between the brother and sister in the prison had been overheard by a monk, or friar, who was none other than the Duke in disguise. He was filled with anger to find that Angelo was abusing his trust. In a flash he thought of a clever way to outwit Angelo and bring happiness where so much sorrow threatened.

There was a lady named Mariana, whom Angelo, five years before, had vowed to marry. He had not kept his word as she had no marriage dower. Yet Mariana loved him still. Isabella was to make pretense of agreeing to Angelo's proposal for the sake of her brother. But she must arrange with this Mariana to take Isabella's place at the wedding, wearing a veil, so that the bridegroom would not discover the ruse until it was too late. Mariana had also to say to Angelo when she appeared before him veiled: "Remember now my brother."

All this was carried out accordingly. But there had died in prison a pirate whose hair and beard resembled those of Claudio. The Duke managed to get the head of this dead man sent to Angelo with the intimation that it was the head of Claudio! Meanwhile, Claudio himself, thanks to the Duke, had been taken out of danger.

Now was the moment for the Duke to complete the discomfiture of his unfaithful deputy. Withdrawing from the city, and dressing again in his proper clothes, he sent forward news that he was returning from Poland. Angelo came to the city gate to meet him. The usual friendly speeches were made, the Duke appearing ignorant of all that had happened. Then came forward Isabella, pretending to appeal to the Duke to punish Angelo for having murdered her brother. Angelo was indeed dismayed when the veiled lady he had but newly wedded also came forward and disclosed herself as his old sweetheart.

The Duke threatened to visit upon Angelo the fate which the latter had designed for Claudio. But both Isabella and Mariana begged that he might be pardoned, and this the Duke agreed to. Nor did Isabella refuse the offer of the kind-hearted Duke to make her his own wife. And so the comedy ended, with happiness for all. We can see why it is called Measure for Measure, since Angelo was made to feel himself in very much the same position as he had placed Claudio.

THE WINTER'S TALE

THERE were two Kings who had been brought up together and grown to like each other so well that they were almost like brothers. The one was King of Sicilia, Leontes; and the other, Polixenes, reigned over the kingdom of Bohemia. Once when Polixenes was on a visit to Leontes, the latter had so enjoyed his society that he begged his friend to stay longer. But Polixenes seemed bent on returning to Bohemia, until Hermione, the tender and loving queen of Leontes, joined her entreaties to those of her husband. Then Polixenes yielded to her gentle persuasion and decided to prolong his visit.

Unhappily, Leontes, though in the main a good and kind king, must have been of a jealous nature. Although he had asked his wife to urge Polixenes to stay, Leontes suddenly became foolishly jealous of Polixenes. In his folly he told his servant Camillo that he believed Polixenes and Hermione had fallen in love. Camillo knew this was not true, but he humored the jealous King by promising to poison Polixenes if what Leontes said was true. What he did was to tell the King of Bohemia of the madness that had come upon his old friend. And that night both Polixenes and Camillo fled away from Sicilia.

Nothing would persuade Leontes of his folly. He accused his poor Queen of acts and thoughts of which she was entirely innocent. He even refused to look upon their newborn daughter, Perdita, and ordered that the child should be taken and left to die in a desert place.

Naturally, Hermione denied the unjust charges brought against her, and in this she was supported by the famous oracle at Delphi. This oracle was supposed to be the voice of the gods, which in those pagan times could be consulted through the priestess in the great temple of Delphi. It was, of course, entirely superstition. But the answer that came from Delphi as to Hermione's conduct said she was entirely innocent, whereas Leontes was a jealous tyrant, who would not have an heir to his throne "if that which is lost be not found."

Soon the words of the oracle seemed

to be coming true, as the King's only son, the young Prince Mamillus, died of grief at his mother's woes: Hermione herself became so ill that it was said she, too, had died.

Too late the jealous King realized his folly. Now that he believed both his wife and son to be dead, he declared he would visit their graves each day and spend his years in mourning.

But Leontes did not know that, while the officer who had taken the little Perdita to a desert part of Bohemia had himself been killed by a bear, the child had been rescued by a shepherd. This man knew from certain jewels and other things the officer had with him that the child was of royal birth. Still he took no steps to find out her parents. He brought her up as his own daughter, and watched her with joy and delight as she grew into the loveliest shepherdess that ever was.

Sixteen years had thus passed, and Perdita found herself beloved by a brave and handsome youth who often came to visit her as she tended her sheep. But whence he came she did not know.

After all these years, too, Camillo, who had lived with Polixenes since they fled from Sicilia together, had a great longing to return to his native country. But the King of Bohemia was loth to let him go, as he wished that they should go together in disguise to discover why the young Prince Florizel was so often absent from court and loved to spend his time in the country.

This Camillo agreed to, and their discovery was indeed a surprise to the King. Florizel proved to be none other than the sweetheart of Perdita, the shepherdess, whom he wished to marry. The King, of course, sternly forbade him, and threatened to have Perdita removed if she ever saw Florizel again. But Camillo now carried out his wish to return to his native land, and took with him, in disguise, both Florizel and the lovely shepherdess.

Leontes gave a warm welcome to the son of his old friend whom he had so greatly wronged. The old shepherd, having followed the runaways into Sicilia, disclosed the parentage of Perdita, to the joy of her father.

Then came the happiest event of all. Paulina, a dear friend of Hermione and widow of the officer who had taken Perdita away, invited Leontes to see a beautiful new statue of Hermione. When he did see it, so lifelike it seemed that he could scarce forbear to touch it. Suddenly the figure descended from the pedestal and laid her head upon his breast. It was Hermione alive, for she had never been dead! The reunion between the King and Queen was blessed by the appearance of Perdita.

Leontes, now happier than his former folly gave him any right to be, became friendly again with Polixenes. Of course, Florizel and Perdita were married in due course, thus uniting the fortunes of the two kingdoms.

MUCH ADO ABOUT NOTHING

RETURNING from battle with some of his principal followers, Don Pedro, Prince of Arragon, an ancient kingdom of Spain, broke his journey at the town of Messina to rest for a time as the guest of its governor, Leonato.

This Leonato had a daughter as gentle and good as she was beautiful and clever. Her name was Hero. She and her cousin Beatrice, who was witty and merry, more lively, but not quite so even-tempered as Hero, made the home of Leonato bright and happy. It so happened that in the train of Don Pedro there was a young and brave gentleman of Florence named Claudio, a great favorite of the Prince because of the soldierly service he had rendered him.

Claudio was very happy in going to Messina, as he was in love with Hero, whom he had seen before. He now rejoiced that the Prince had promised to advance him as suitor for that charming lady's hand.

There was another gentleman of the Prince's train named Benedick, a young nobleman from Padua, who was also a favorite of Don Pedro. He, too, was brave and manly, but more moody than Claudio, sometimes liking to read a book rather than to make himself agreeable to the ladies. All went smoothly so far as Hero and Claudio were concerned. Not only was it clear that they loved each other, but, Leonato having given his consent to their marriage, preparations for that happy event were soon in progress. Meanwhile, every time that Beatrice and Benedick had met they had found occasion to quarrel. Though they seemed to like each other's company, one might have thought, to hear them, that nothing would ever induce either to marry.

Now, when a couple are engaged to be married they are usually so happy that they like to see others happy also. So it was with Hero and Claudio. Together with the Prince and Leonato they agreed upon a little plan to make Beatrice and Benedick cease their bickering and love each other.

One day when Benedick had withdrawn to a shady arbor in the garden, the Prince, Leonato and Claudio seated themselves near his retreat. They began to talk, so that Benedick might hear them in his arbor, about the way in which poor Beatrice was dying of love for him! They pretended that she was deeply in love with Benedick, and yet Hero had said: "Beatrice would die ere she made her love known."

This, you will see, was the beginning of their little scheme. It is no wonder that Benedick, overhearing their remarks, began to think his behavior to Beatrice had been cruel and ungallant.

Meanwhile, Hero had her part to play in this pretty comedy of love. She sent one of her attendants to tell the unsuspecting Beatrice that Hero and another lady in the garden were talking about her. It was not many minutes before the lively and inquisitive Beatrice stole out to overhear what they might have to say. Their talk was all about Benedick's being deeply in love with her. They also spoke in so much praise of him that Beatrice forthwith became as tender in her thoughts toward him as he had become toward her.

But into this happy comedy the figure of a mischief-maker now stepped. This was Don John, half-brother of the Prince, whom he hated so much that he would do anything to annoy him. For the moment he could think of nothing better than to stir up the feeling of jealousy between the Prince's young friend Claudio and the unsuspecting Hero. He assured the lover that Hero had really given her heart to another gallant. He induced both Claudio and Don Pedro to hide with him in the garden on the eve of Hero's intended wedding day. At Hero's window they beheld a lady bidding farewell to an unknown man. This was merely one of Hero's lady companions saying good night to her own sweetheart, a follower of Don John. But Claudio and the Prince were both misled into thinking it was Hero herself.

Claudio, mad with rage, swore to renounce the innocent Hero at the altar next day. This cruel threat he actually fulfilled, and the poor lady, utterly at a loss to understand the cause, almost died of grief. Her cousin Beatrice, of course, would not believe her capable of any dishonorable action, and made Benedick, now really in love with herself, undertake to fight a duel with Claudio.

In the meantime it was pretended that Hero had actually died. Benedick had challenged Claudio to the duel, just when Dogberry and Verges, two comically stupid officers of the watch, brought in two of Don John's followers whom they had arrested at night, believing them to be scheming at some plot. To save himself, one of the prisoners at once confessed that he had visited his sweetheart that night so that when she came to the window the watchers in the garden might mistake her for Hero. This he had done at the instigation of Don John.

Claudio, on hearing this, was overwhelmed with grief, and believing the innocent lady to have died, he was in despair. But Leonato told him his brother had a daughter the very image of the child he had lost. If Claudio would marry her he would forgive him the sorrow he had caused by his folly in listening to slanderous tongues. Claudio said he would marry Leonato's niece even if she were an Ethiope and Antonio, Leonato's brother, at once appeared with several ladies, among whom was his daughter.

When this new bride came to meet her bridegroom, her features were masked. Judge of Claudio's surprise when she uncovered her face and he looked again into the dear eyes of Hero. Benedick discovered Beatrice in the group of masked ladies and asked her if she loved him. True to her nature, the lady began to tease him. But Benedick was her match. He offered to marry her out of pity. She consented to save him from consumption and a kiss sealed the bargain.

The threatened duel between Claudio and Benedick had now no excuse. All were friends again, and not only do we see Hero and Claudio ready for their wedding, but Beatrice and Benedick also.

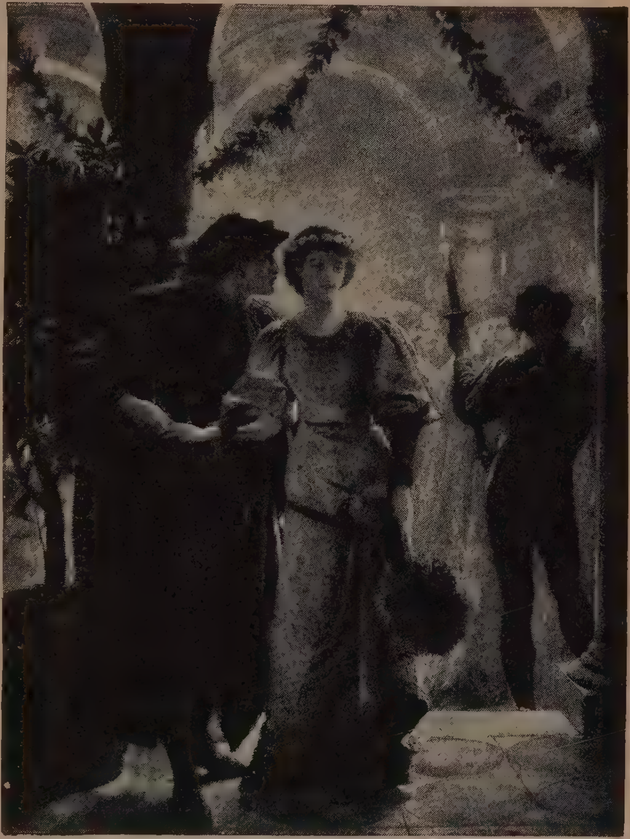
ROMEO AND JULIET

IN the ancient Italian town of Verona lived two noble families who were at deadly enmity with each other. One family was named Montague, and the other Capulet. Romeo, the brave and handsome youth, heir of the Montagues, was in love with a lady called Rosaline. She refused to have anything to do with him, which made him so sorrowful that he shunned all gaiety and lay sleepless at nights. It chanced one day, when Romeo was speaking in the street with his cousin Benvolio, that a servant came to him asking if he could read a paper he carried. On this paper were the names of the guests to whom he was bearing invitations to a ball given by the great Capulet. Romeo noticed Rosaline was to be among the guests, whereon Benvolio suggested they should go to the ball masked. For he thought that if Romeo saw many lovely ladies there he might forget the disdainful Rosaline.

The lover felt it would be impossible ever to forget Rosaline. But when, in due time, he was mingling with the dancers in his foeman's house, he saw a lady so fair that she seemed to be "a snowy dove trooping with crows." He determined that he would speak to her as soon as he could. While he was asking a servant the name of the fair one, Romeo was recognized by Tybalt, a young Capulet, who wanted to challenge him. But the lord of the house kept his kinsman back, saying that Romeo bore himself like a gentleman, and was said to be "a virtuous and well-governed youth."

Romeo had now come up to the fair lady, and kissing her hand, had spoken a few words of admiration and received the assurance that he was not displeasing to her. But when he knew that she was none other than Juliet, the only child of Capulet, he was very sad. For he had fallen in love with the daughter of his father's mortal enemy.

At midnight Romeo departed, but he felt that he could not go homeward and leave the place where Juliet was. So he climbed over the orchard wall into Capulet's garden. While he was hidden by the darkness of the night he saw the lady appear at the window. She called his name to the night air, saying:



At a ball in Verona, Romeo, the heir of the Montagues, a family at feud with the Capulets, falls in love with Juliet, the only daughter of Capulet, not knowing who the lady is. Thus begins one of William Shakespeare's great tragedies, the story of which is here retold.

"O Romeo, Romeo! Wherefore art thou
Romeo?
Deny thy father, and refuse thy name;
Or, if thou wilt not, be but sworn my love,
And I'll no longer be a Capulet."

When she had spoken more words in this strain, Romeo stepped forward and told her that his name was now hateful to himself, since it was that of her family's enemies. That night they vowed their love for each other, and purposed to be married at all risks.

In the early morning we next see Romeo at the cell of Friar Laurence, a priest, who thought the lover had come from his usual sleepless night weeping over Rosaline's hardness. The holy man was surprised to hear of the new love, but rejoiced to think that now, perhaps, the feud between the Capulets and the Montagues would come to an end with the union of this couple. Willingly he consented to marry them secretly.

Before long Juliet herself arrived, and presently the priest had made her Romeo's bride.

Soon after this Romeo's friend, Mercutio, a kinsman of the Prince of Verona and a very quick-tempered man, engaged in a quarrel with Tybalt, and Romeo appeared on the scene. Tybalt immediately turned upon Romeo, who, having so lately wedded a Capulet, now felt kindly toward the family and refused the challenge. Thereupon Mercutio drew his sword on Tybalt, but the latter killed him.

Romeo could not let his friend's death pass unavenged, and scarcely had he slain Tybalt when the Prince arrived. He had long been vexed by these family feuds, and now his displeasure was so great that he banished Romeo.

Friar Laurence advised Romeo to flee to Mantua, and there to wait until he could make his marriage known, implore the Prince's pardon, and come back to Verona. Juliet's old nurse brought Romeo a ring from his young bride, and after a brief meeting with Juliet he hastened from Verona.

Juliet was plunged into sorrow, but her mother thought it was for the death of her cousin Tybalt. When a young nobleman named Paris asked for her daughter's hand, Lady Capulet agreed that they should be married within a few days, and began to make active preparations for the wedding.

At first Juliet refused, and then she went to take counsel of the Friar, saying she would kill herself rather than be married to Paris. In a desperate plan of escape the Friar gave her a phial, from which she was to drink on the eve of the wedding her mother had arranged. It contained a drug which would make Juliet fall into a trance with all the appearance of death, and she would then be taken to the family vault. Meanwhile Friar Laurence was to send for Romeo, and when Juliet had awakened from her long sleep, her lover would be at her side ready to take her with him to Mantua. Juliet agreed to this.

The strange and dangerous scheme of the Friar was carried out so far that Romeo came to the tomb after Juliet had been placed in it. But he had come thinking she was really dead, and had provided himself with poison that he might die beside her. Paris, however, was there before him, having come to strew flowers on Juliet's coffin. The two men quarreled and fought at the grave, Paris being killed.

When Romeo had opened the vault, he laid the body of Paris beside that of Tybalt. Then he gazed on the beautiful face of his wife, kissed her for the last time, and drank the poison.

Romeo had been in the tomb for half an hour when Friar Laurence came to find Juliet, as it was now time she should recover. On entering the vault he saw Romeo lying near the blood-stained Paris, and called anxiously to Juliet to arise, for she was now beginning to show signs of life. She awoke, and he told her that if she would but come, he would put her "among a sisterhood of holy nuns." But hearing the sound of approaching footsteps, he fled.

When the sight of her dead Romeo and the bleeding Paris met the awakened eyes of Juliet, she was overcome by sorrow and snatched up Romeo's dagger and stabbed herself.

The watch, who had been called by the page of Paris, entered the churchyard and were horrified at what they saw. Paris was dead of wounds; Romeo was stiff and stark from the poison; and Juliet's dagger-thrust had freed her from life.

The watch waked the Prince and then summoned the Montagues and Capulets, and the Friar was brought back. He explained to the astonished company the cause of the tragedy. When the Prince reproached them with the death of the youthful lovers on account of the feud between the families, Montagues and Capulets alike were stricken with remorse.

Montague reared to "the true and faithful Juliet" a statue of pure gold, and the same honor was paid to Romeo by Capulet. Thus ended the rivalry and hatred of the two families.

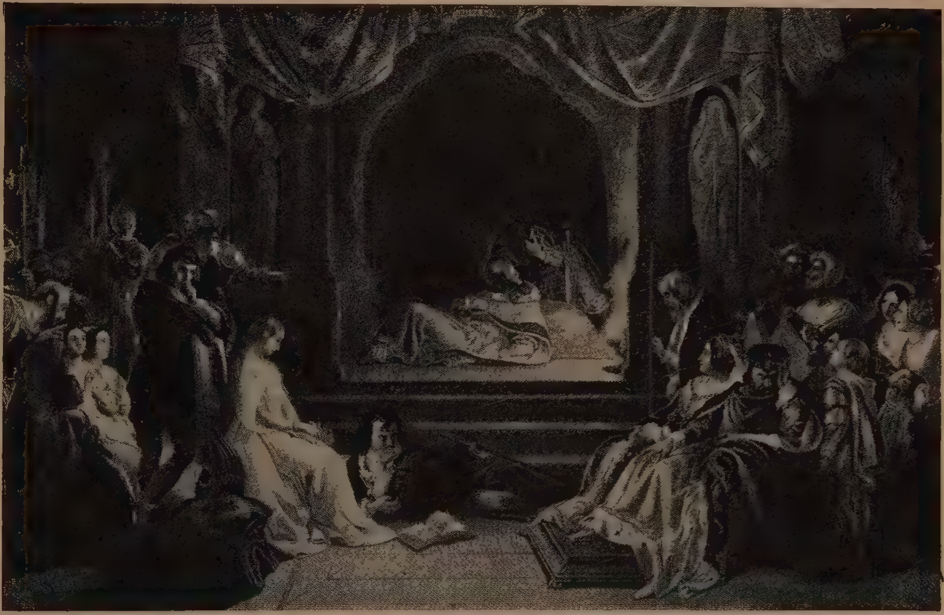
HAMLET, PRINCE OF DENMARK

PRECISELY as the clock struck twelve at midnight the ghost of the former King of Denmark used to appear on the walls of the Castle of Elsinore. Scared soldiers of the guard told Prince Hamlet of this, and he determined to speak to his father's spirit the next time it appeared. For this purpose he waited through the cold, dark night until the midnight hour, when the ghost was seen beckoning to him. His faithful officers would have detained him, but Hamlet broke away and followed the spirit.

Hamlet had been so full of love for his father that his grief for the King's death, two months before, had increased daily rather than lessened. This grief was now mingled with horrified anger at his own mother, Queen Gertrude, who had married his father's brother Claudius less than two months after the death of the King.

The young Prince's mind was full of strange unrest at this disgraceful conduct, and he was suspicious as to the death of his beloved father; so that when the ghost revealed to him the fact that he had been poisoned by his brother, in order that the latter might wed his queen and sit upon his throne, all Hamlet's thoughts turned bitterly to means of vengeance. Encouraged by his father's spirit, he resolved never to rest until the usurper had paid for his crime. The better to carry out his plans, he feigned madness, speaking strangely even to Ophelia, a beautiful maiden whom he loved.

It chanced that a company of players came to the castle, and Hamlet, looking everywhere for means to convict the new King of his crime, suddenly conceived that by means of these play-actors he might bring home to his mother and stepfather his knowledge of their evil deeds.



Hamlet, Prince of Denmark, had sworn to avenge the death of his father, who had been killed by his own brother Claudius pouring poison in his ear as he slept. Claudius had then married the dead King's widow. Hamlet got some actors to perform at the Court a play which recalled the death of his father. Claudius and the Queen were greatly disturbed by the performance, Hamlet watching their behavior closely.

With this end in view, Hamlet arranged that the company should perform the next day a play dealing with the murder of a Duke of Venice. Into this some new lines which Hamlet was to write were to be introduced. We can guess that these new lines would refer to a King poisoned by his brother so that the latter might enjoy his possessions and wed his widow. For Hamlet exclaimed, when he had made this arrangement with the players:

"The play's the thing,
Wherein I'll catch the conscience of the King."

And so it all fell out. When the tragedy was performed before the King and Queen next day, the mimic deeds enacted on the stage were like in every detail to the manner in which Hamlet's father had been done to death, by the pouring of a poisonous drug into his ear as he lay asleep. The guilty Claudius and Queen Gertrude could stand it no longer and left the room in great excitement and disorder.

The play had caught the conscience of the King!

In great agitation Claudius expressed to Queen Gertrude his wrath against Hamlet, and bade her reprimand her son for his strange conduct. She summoned Hamlet to her private apartment. Ophelia's father, the aged Polonius, who was Lord Chamberlain of the kingdom, remained hidden behind a curtain, fearing lest some violence might result from the Prince's supposed madness. When the Queen reproved her son for having the play performed, he straightway told her that he would not let her go until he had "set up a glass where she might see the inmost part of herself." So wild were his words that the Queen, fearing he would kill her, called for help, and Polonius echoed the call. Hamlet, pretending that the disturbance was created by a rat behind the curtain, thrust in his sword and killed the old courtier. Then, with wild, strange words of scorn, he reproached his mother till she entreated him to speak no more.

But sad was the fate that befell the beautiful Ophelia. Believing her lover's affection to have turned to hatred, and hearing of her father's death at his hand, she did naught but brood over her woes. At length her mind gave way.

King Claudius, of course, had but one thought now—to be rid of Hamlet, whom he believed to possess his secret. The Prince was sent to England with a sealed letter from Claudius in which the King desired that Hamlet should be put to death on landing. But this was not to be. The ship bearing the Prince was attacked by pirates, who took all on board prisoners, eventually restoring Hamlet to Denmark. Returning to Elsinore, he and his faithful friend Horatio entered a churchyard where a new grave was being dug. There they stood watching the gravediggers, little dreaming for whom the grave was being made. Presently appeared a funeral procession. Hamlet and his friend withdrew, but from their hiding-place they saw the corpse of Ophelia borne in the midst. That unhappy girl had been drowned while gathering flowers by a brook.

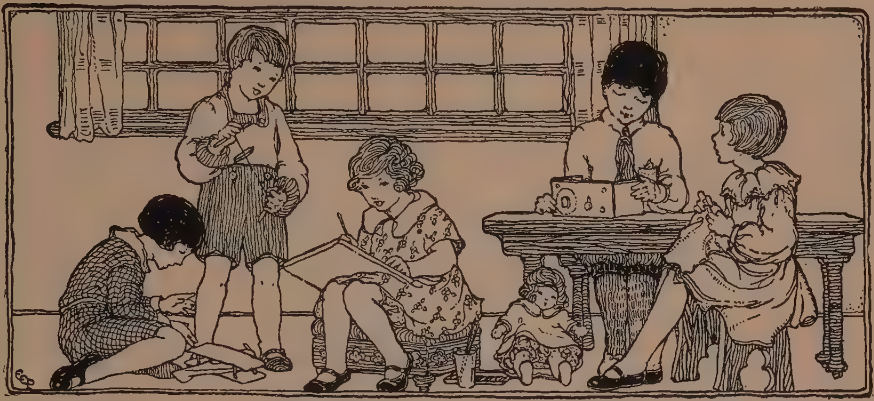
Tenderly the body was laid in the grave. Laertes, Ophelia's brother, distraught at her death, threw himself upon her body and begged that he might be buried with her. Hamlet then ran forward and leaped in beside the living and the dead. A fierce struggle ensued, Laertes accusing Hamlet of his sister's death, since his conduct had turned her mind. But in the end they all withdrew, and poor Ophelia was left in her grave.

Laertes had returned from France at the death of his father and had been persuaded by the King that Hamlet was the cause of all the troubles which had come upon his family. Laertes had listened to the wily words of his sovereign and had sworn that he would have his revenge on the Prince. Claudius had flattered him concerning his swordsmanship, and Laertes had readily agreed to engage in a duel with Hamlet in which by the use of a poisoned rapier he would fatally wound him. To make doubly sure of Hamlet's death the King had planned to have a poisoned drink for Hamlet, should Laertes fail to kill him. The King had appealed to Hamlet by making a heavy wager on his ability as a swordsman, and Hamlet had accepted the challenge.

The whole court assembled to witness the combat. For a time chance seemed to favor Hamlet. Then the opponents unknowingly changed swords, but not before the Prince had received a wound from the poisoned point. Laertes, in his turn, was wounded with the same sword. Meanwhile, Queen Gertrude, drinking in honor of her son's clever swordsmanship, partook of the deadly wine and died.

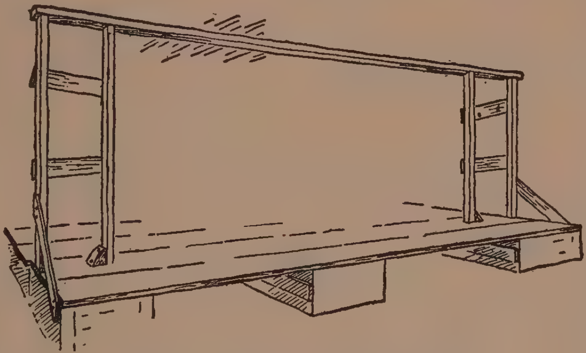
The death of his mother showed Hamlet the last villainy of the wicked Claudius, which had entirely miscarried and robbed him of his Queen. Laertes, dying, forgave the Prince, and seeing all clear at the last, denounced the King as the cause of all their woe. Hamlet, turning his steel on Claudius, made the murderer drink the deadly cup himself. Presently the poison carried by the sword into the wound which Hamlet had received took effect, and the chief actor in this strange, sad tragedy closed his eyes forever in death.

THE NEXT STORIES ARE ON PAGE 5823.



HOW TO PREPARE FOR AMATEUR THEATRICALS

ALL amateurs will be interested in the following description of how a stage and its accessories may be prepared in the house. In most houses there is at least one room which is suitable for conversion into a theatre. Even a large garret that has sufficient head room may be used if no other room is available. Precaution should always be taken in selecting a place for a stage to make certain that there is good access from other rooms which are being used.



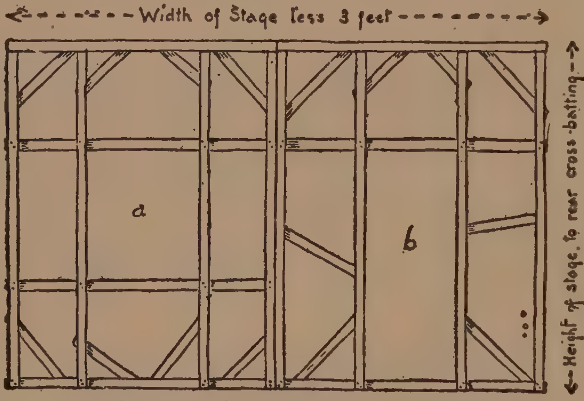
1. Method of building stage and framework.

While a section of the floor may be used as a stage, the raised stage is more desirable, even though it entails additional cost. It will add materially not only to the comfort of the spectators, but also to the players' effects. A simple way to erect a solid platform, which will do away with horses and expensive cross-supports that would require the aid of a practical carpenter, is to utilize starch, soap or canned-goods boxes of a similar size. Taking it for granted that the width of the average room at the disposal of the actors is 18 feet, get, say, fifteen soap boxes, and place five of them end to end in three rows. Along the side of each section of boxes nail a strip of wood to keep the three separate rows in line. Place the two outside rows about 3 inches from the baseboard on either side of the room. Then take boards 16 feet long and lay them at right angles over the box-supports, and fasten them. Screws are to be preferred, for then the stage can be easily taken up and put down again. Following these instructions, a stage free from spring should be the result.

If possible, the boards should be covered with a green or brown cloth—the thicker the better—in order to deaden the sound of feet on the wood. Other colors can be used, but these colors are preferable. For an interior they make a good groundwork, on which may be placed rugs of varying size.

The most important and at the same time the most difficult parts of a theatre for an amateur to build are the framework of the proscenium and the outline of the stage by which the scenery is supported. The proscenium is the covered front of the stage which, with the curtain, shuts off the mysteries behind from the spectators in front. Against the boxes at either side of the room, about 1 foot or 18 inches from the edge of the same, nail or screw uprights 2 inches wide by 1 inch thick. These uprights should reach to within 1 inch of the ceiling. Take, then, a piece of wood, just short of the width of the room, and, covering it with something soft, like Canton flannel, stretch it across the ceiling of the room, driving the ends over the uprights and making a close joint. Two similar uprights 2 feet from the side edges of the stage should then be placed in position. Brace them to the stage, and have them of such a length that when bent under the crosspiece stretching across the ceiling they will be firm. Braces should be used to impart the necessary solidity to a structure that must bear the weight of the curtain. Picture 1 shows how the framework should look.

If the stage is 18 feet deep, at 9 feet from its outer edge, or the footlights, erect similar uprights on the outside, with a crosspiece running the width of the room, covered, as before, with Canton flannel. At the extreme rear of the stage this arrangement should be repeated, stays or braces being used to give it additional strength. The three uprights on either side of the stage should then be braced by a board 2 inches wide by 1 inch thick running the full depth of the stage. By following these instructions the entire stage will thus be outlined by a light but firm framework, capable of standing such strain as may be put upon it by scenery, draperies and hangings. It is almost impossible to stretch wires or ropes from wall to wall, for this purpose, and get a pleasing result; they are sure to sag, and thus present a most unsatisfactory effect. The method proposed of course entails work and some carpentry, but much of the fun of amateur theatricals is in devising effective substitutes for the conveniences to be found in the regular theatre.


Width of Stage less 3 feet
Height of stage to rear cross-batting
a
b

2. Construction of frame for back-drop.

The proscenium must now be covered and the curtain hung. The material used to cover this outer frame should be as light as possible.

If the material is to be painted, unbleached muslin is recommended. This should first be sized, and water colors used. Sizing is a mixture composed of water and glue, and it is laid on with a broad brush similar to that employed by whitewashers. For coloring purposes dry water colors must be used. These should be mixed with enough water to flow freely. If this method is not employed, something like Canton flannel may be used. This material comes in such attractive colors, it is possible to produce very pleasing effects when combined with a curtain of a different shade. If possible, a curved effect should be given to the cloth which stretches across the opening.

When the curtain has been sewed together in perpendicular strips, five rows of brass rings, placed 6 inches apart, should be sewed from the top to the bottom of the curtain. The top of the curtain should then be securely attached to the crosspiece of wood running the width of the room. Also attached to the bottom should be a stick of wood or a piece of gas-pipe. This batten should be wider than the proscenium opening, so as to prevent the curtain from getting out of place.

Calling the left-hand side of the stage as you face the audience the prompt-side—that is, the place where the man who prompts and runs the curtain stands—strong white cord may be attached to the extreme right end of the batten. It is then passed up through the little brass rings sewed to the curtain, and through large screw-eyes attached to the crosspiece of the proscenium arch. At the left end of this crosspiece there should be a large screw-eye, through which the cord descends to the curtain-man's hand. Another cord should then be similarly attached to the batten at the foot of the next row of brass rings, and so on through the screw-eyes at the top down to the curtain-man. Similar cords should be fixed wherever there is a row of brass rings. The ends of the various cords should then be tied together, leaving sufficient slack to twist around a cleat on the prompt-side, so that they may be made fast when the curtain is up. By this arrangement the cords, when pulled, will draw the curtain up in a satisfactory manner. However, the man working them should see that the cords retain their relative positions, otherwise the curtain might not fold evenly.

The proper arrangement of lights is absolutely indispensable. It is most desirable that the light should be thrown upon the faces of the actors, so that the audience may get their expressions. Light from above often casts shadows. If there is gas in the house, and the connection can be easily made, it will be found suitable for footlight use. The fact that it can be controlled makes it doubly advantageous. In this way, natural effects can be simulated, and entrances of characters upon darkened scenes with lighted lamps or candles can be made realistic.

In arranging the footlights care should be taken to provide against danger from fire. Have the board which covers the support of your stage from the eyes of those in front reach about 4 inches above the stage. It is advisable to line the inside of this elevation above the stage with tin, and to have the tin extend over the stage its full width, about 8 inches, to the rear. This will not only protect the woodwork thereabouts, but will act as a reflector as well. In proportion to your other expenses your footlights and accessories will probably cost you quite a little sum, but the outlay will be justified by the results you will obtain from having a practical plant.

You may go to a plumber, and from him get a piece of gas-pipe; have it cut off the width of your proscenium opening, and closed at one end. Then, at intervals of 18 inches, have holes bored in it, inserting in each hole an ordinary gas-plug. It will not pay you to have too many of these jets, for since you will get your gas-supply from one ordinary burner, there will not be force enough to give you many flames of any size. Now set this pipe on the tin, and fix it firmly by means of hasps and small wooden blocks, so that there is no danger of its falling over. To the open end of the pipe affix a rubber tubing, tying the joint tightly, that there may be no leakage, and have the pipe run to the nearest side-wall gas-bracket. Remove the tip of the burner, in order that the gas may have as free a flow as is possible. Then see that the tubing passes to the bracket in a way that will prevent its being stepped on, otherwise your lights may be extinguished. The ordinary stopcock on the bracket will enable you to regulate the amount of light you wish to throw upon the performers and the scene. If it is not possible to surround each footlight with a small wire screen, you may stretch some wire netting from the top of the piece of wood which screens the light from the eyes of the audience to the rear of the tin sheathing. If a gas connection is impossible, lamps or candles may be substituted at regular intervals. If the latter are used, those of paraffin that come sixteen to the pound should be obtained. Of course, neither of these methods will permit you to get graduated effects of light.

Scenery is the next important provision to be made. When that is arranged for, your theatre will be ready for practical use. The usual scene adapted for amateur presentation has its action take place indoors. Many a good play has to be abandoned by beginners because it is impossible for them to rig up anything that will be suitable for a landscape scene or for a view of the coast. As a general proposition it may be stated that at the outset a scene should be selected which calls for an indoor setting.

If extreme simplicity is desired, the use of a back-drop and wings is recommended. If there is to be more than one play, both requiring interiors, it is much easier to use the same background and to effect the changes by the use of different hangings, furniture and bric-a-brac. In this case the back-drop should be made on a frame in two pieces, which are covered with unbleached muslin. A serviceable arrangement would be to make this framework on the outline shown in the diagram in picture 2, with *A* an open space for a window, and *B* an open space for a door.

The material used should be, if possible, pine-wood strips 2 inches wide by 1 inch thick. The joints and corners must, of course, be carefully squared to make a good fit. The frame should then be covered with the muslin, and if the interior to be used is to represent a drawing-room or bedroom, no better method can be devised than to cover this surface with some appropriate wall-paper. For the door and the window separate framework will, of course, need to be made. Painting these to represent the real article will require some study of originals. For the wings, the average depth of stage in a private house will require two on either side. They should be made of the same material as the back frame, and should be similarly covered. To have these screen the sides they should be placed at the proper angle to the footlights.

For a box scene the sides should be made similar to the mounted back frame as just described, arranging them in the matter of doors and windows as the action of the average play demands. This means ordinarily that there should be at least one door on each side. If necessary, a door-opening can very readily be converted into a window opening to the ground, and either one may be painted on a framework covered with muslin. For modern interiors it is useless to use other than wall-paper, and even for medieval interiors something appropriate can readily be obtained. A kitchen or a garret can also be made out of wall-paper.

If a palace interior is required, the utmost skill will be demanded. One might take as a model a picture from some book. The one most free from architectural ornateness is advised. The back frame once covered, usually—the entrance in it should be in the centre and have an arch—the muslin should first be sized, and then allowed to dry.

As already stated, frequently a good play is barred mainly because an exterior scene representing a garden or landscape is required. To secure the desired effect by painting Nature in her proper setting is a difficult task for the amateur artist. However, it is now possible to buy such scenes printed on separate sheets of paper, which can be pasted, somewhat like wall-paper, on the covered frames.

HOW DID THE FARMER ENLARGE THE FOLD?

A FARMER had 50 hurdles, and with these he made a sheepfold that would hold exactly 100 sheep. Later on, as he had a good deal of fine pasture land, he decided to increase the number of his sheep, and so he went to market to buy some more of these animals. Prices were low and, although he had intended to buy only about 50 more sheep, he changed his mind and bought 100. The result was that, having now double the number of sheep that he possessed originally, he would require double the accommodation in his fold. His companion mentioned the matter.

"Oh," said he, "I had forgotten that; but it is easily put right. I must buy two more hurdles and then I shall have sufficient room."

"Only two more hurdles to give you double the space in your fold? You have made a mistake," said the friend.

But the farmer was quite sure he was right, and he bought only two hurdles, although his friend said that he would require more.

The next day the farmer met his friend.

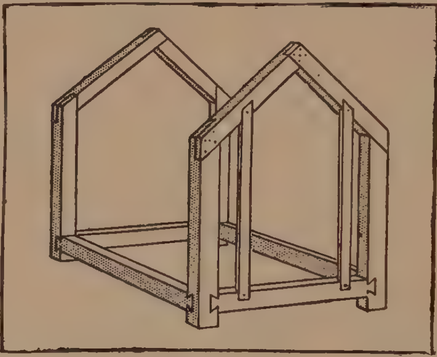
"Well, I have doubled the accommodation of my sheepfold, and found the two extra hurdles quite sufficient," said he.

The friend seemed very doubtful, so the farmer took him to the field where the fold was, and in a moment the friend saw that the farmer was right. How did he do so much with only two hurdles? The answer to this little problem will be found on page 5890.

MAKING A KENNEL FOR A DOG

THE size of the dog kennel that we shall make will depend upon the size of the dog that is to occupy it. In making our kennel we must consider the comfort and health of the dog for which it is to serve as a house and sleeping-place. We shall assume that our kennel is to stand in the open air, in a corner of the garden, for instance. We must select a corner where it will not be too much exposed in bad weather and where it will be sheltered from the cold and biting winds.

The kennel itself must be made so that it stands a little way off the ground, in order to keep the floor dry in wet weather, for dogs take cold as well as human beings, and they love warmth and comfort almost as much as we do. Also we must provide ventilation, so that there is always a current of air through the kennel. Then our dog's bed must be of a nature to make him comfortable. A piece of rug or carpet, or a little clean straw on the floor of the kennel, will do very well.

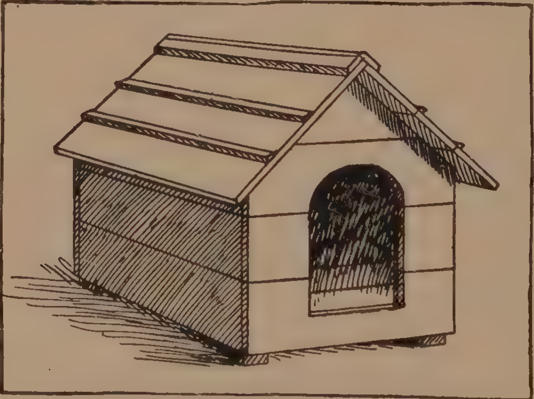


1. The framework of the dog's kennel.

The length of the kennel inside should be half as long again as the dog when he stretches himself out, and the width inside should be wide enough to allow him to turn round without difficulty.

The first thing that we make is the frame of our kennel, which is shown in picture 1. The wood used should be 2 inches square. This is quite strong enough if we join it properly where the pieces meet. The picture will show us clearly how the wood is checked at the corners. Care should be taken to make the joints fit well, because it is upon this that the strength and the durability of the kennel will depend.

When we have made the frame, we may proceed to make the floor and walls. The floor-boards should be thick—not less than ¾ inch—for thickness means warmth. They are laid across from side to side on top—not under—the long frame-pieces seen in picture 1, and nailed into position with good strong nails. Now we can put on the sides, made of wood running from front to back, as seen in picture 2. This wood should be not less than ½ inch thick. It is important to have the edges of these boards smooth and straight, so that we can put the pieces tightly against each other without leaving a long crack through which a draft would come into the kennel and harm the dog.



2. The kennel as it appears when finished.

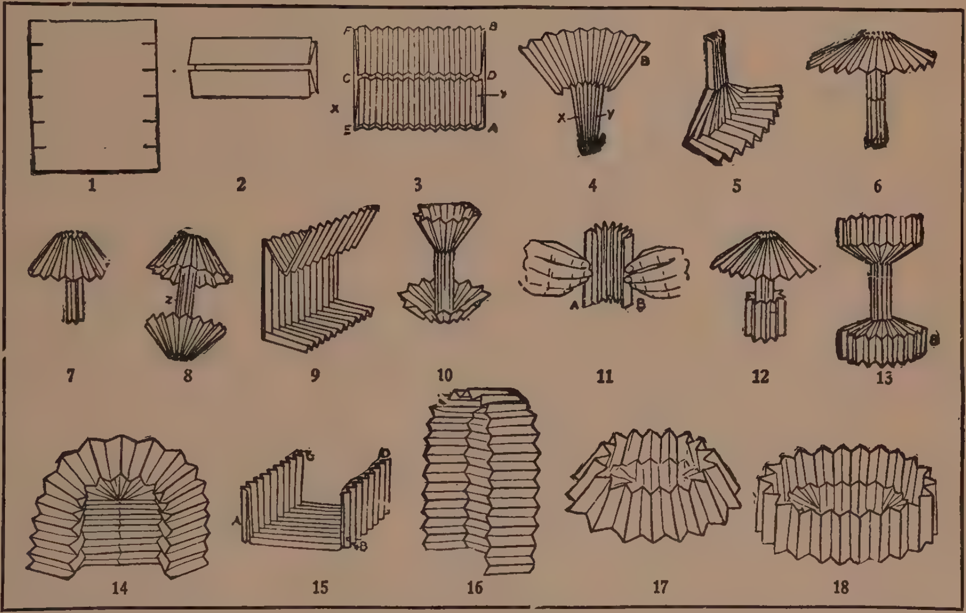
The front and back must next be made and fitted. We make the back boards similar to those from which we made the sides, and nail them across. At the top we must saw the ends off so as to slope to the shape of the sloping frame that forms the end of the roof. Again, we must see that the boards are fitted tight up to each other, so as to leave no draft space. Now we are ready for the front. It is made exactly the same as the back, except that we must leave an opening with an arched top to form the doorway. The two extra upright pieces in the front of the kennel hold the short front boards at each side of the doorway. We can make the top of the doorway arch-shaped by first marking the rounded shape with a pencil, or by cutting out a paper pattern. Now we cut it out by following the marks with a keyhole saw, if we have one, and, if not, we can use our chisel to do the work.

We have still the two sloping roof-sides to put on. The boards for the roof should be fairly heavy, and they should project about 3 inches over the front and back, and about 2 inches over each side, as seen in picture 2. This prevents the rain from running down from the roof on to the sides of the kennel. Finally, we put slips of wood cut to the shape seen in picture 2 over each seam in the roof, so as to prevent the rain from finding its way into the kennel. The construction part of our kennel is finished, but we should bore five or six holes through the side walls under the projecting roofs, so as to provide the ventilation which is so necessary for the dog. These holes need not be large.

We may paint the outside of the kennel with two coats of paint of any color we think suitable, waiting until the first coat is dry before applying the second, and we should give the inside a coat of lime-wash. A very good color for the outside of the kennel is dark green. This is a serviceable color and always looks well.

THINGS TO MAKE WITH FOLDED PAPER

A VERY great deal of amusement and enjoyment can be obtained from a plain sheet of paper measuring, say, 30 inches by 24 inches, or a smaller piece of somewhat similar proportions. No other apparatus is needed; and yet, by simply folding the paper and then opening it out in different ways, about a hundred different things can be formed. With a little practice we shall get skillful in folding and unfolding the paper, and we can then give quite an interesting entertainment to our friends, giving them a great deal of pleasure. Or, if we are a guest at an evening party, we can "make things go" with the same simple apparatus.



SOME OF THE MANY THINGS THAT CAN BE MADE BY FOLDING A PIECE OF PAPER

1. The paper marked for folding. 2. The first folds. 3. The paper folded. 4. Fan. 5. Bracket. 6. Umbrella. 7. Toadstool. 8. Candlestick. 9. How the folds are pulled out. 10. Vase. 11. How the stems are formed. 12. Lamp. 13. Dumb-bell. 14. Porch. 15. Newspaper-rack. 16. Sentry-box. 17. Jelly mold. 18. Bowl.

It is advisable to take a large sheet of paper of the size mentioned, 30 inches by 24 inches, as the folding is not then so tedious, and it is simpler to manœuvre the paper when folded. If such a sheet is not available, then the experiments can be carried out with a sheet of note-paper cut to the right proportions or thereabouts. Having obtained our sheet of paper, let us mark off on each side six equal parts, as shown in figure 1, and fold the paper as shown in figure 2. Now, by making small neat folds backward and forward alternately in this sheet of paper, which is already folded into three thicknesses, it will appear as in figure 3, and we are now ready to make a great assortment of objects.

By nipping together the end of the folds at *A*, as in figure 4, and spreading out the top, *B*, we get a fan. The next figure, 5, is obtained by inserting the finger at the point *C* of figure 3 and moving it along under the folds to *D*. This pulls out a row of fluted folds; and by holding at *A*, as for the fan, but inverting the paper, we get a bracket.

Now hold the same way up as for the fan, and, keeping the upper folds that formed the shelf of the bracket spread out horizontally, bend round the small folds marked *X* and *Y* in figures 3 and 4 until they meet at the back. We shall then have an umbrella, as in figure 6. By moving the shade part of the umbrella to a sharper angle, we have the toadstool in figure 7.

Draw out the lower row of fluted folds like those that form the top of the toadstool, and twisting the folds of the stem, *Z*, round as for the toadstool, we get figure 8. Now pull out another row of folds at the top, as in figure 9, draw the centre folds together again, and we have figure 10 in its place.

If there is any difficulty in forming the stems and stalks and getting the distended folds to form into round shades and cups and so on, figure 11 will make it clear how this is done. *A* and *B* are the end folds on each side of the concertina-like sheet of paper, and these are drawn round at the back till they meet. This has the effect of twisting all the folds round, so as to form a shade for an umbrella, the top of a toadstool, and so on.

Figure 12 shows a lamp; it is a slight variation of figure 10. By drawing out the bottom folds the same as those at the top in figure 8, and then twisting the stem round as before, we get figure 13. Now, keeping the paper in this form, take the ends of the folds *A* and *B* between the fingers and draw them together. This will give figure 14—a kind of porch. Place the paper as in figure 15, and we have a newspaper-rack. Draw *A* and *B* together, and we have a sentry-box—figure 16. By drawing together not only *A* and *B* in figure 13, but also *C* and *D*, we have a jelly-mold, as in figure 17; and without changing anything, but simply moving our hands farther apart while we hold the jelly-mold, we get a bowl or vegetable-dish, as in figure 18.

These are only a few of the many shapes and figures and models that we can make from a plain sheet of paper. Once we have the paper folded as in figure 3, we can keep inventing our own designs; and when we have become expert and skillful in the use of a paper folded into the sections shown here, we can still further elaborate the folds, and get even more astonishing models.

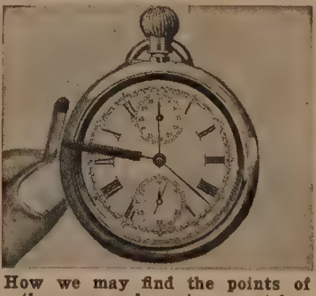
A number of points should be carefully borne in mind. In making the backward and forward folds to prepare our sheet of paper, it is essential to make small and neat folds. If we make wide and clumsy folds, the paper will not have the elasticity that will lend itself to a great variety of shapes and twistings. It is therefore well worth while to take pains to get our paper nicely folded in the first place. Another point to remember is, if we wish to be successful as an entertainer with the magic folding-paper, we must, after making one figure or a series of figures, close up the paper and press the folds well together again, so as to keep them well marked, and thus enable the paper to keep its corrugated appearance. Following these precautions we can make staircases, window-blinds, boxes, vases, hats, mats, Chinese lanterns, and, in fact, there are few objects that cannot be represented by folded paper twisted or turned in a certain way.

It is certainly wise, in the first place, to get paper for our purpose that is tough and will not easily wear out at the folds. If we get a common paper, the folds soon wear into holes, and it becomes necessary to fold another sheet. At the same time, it must be borne in mind that a paper must not be selected so tough that it will not fold neatly and closely.

Before attempting to give a display to our friends, it is of course essential that we should have a great deal of practice in quickly manœuvring the paper. The effectiveness of such a display depends upon the speed and neatness with which we perform.

HOW TO USE A WATCH AS A COMPASS

IT very often happens that we should like to know in which direction the north or south lies, yet, as very few people carry even the simplest form of mariner's compass with them, we are generally content to make a more or less inaccurate guess at it. Most people carry a watch, and if this shows the correct time, and the sun is shining, it becomes quite a simple matter to find the south, and, from that, any other direction.


How we may find the points of the compass by using a watch.

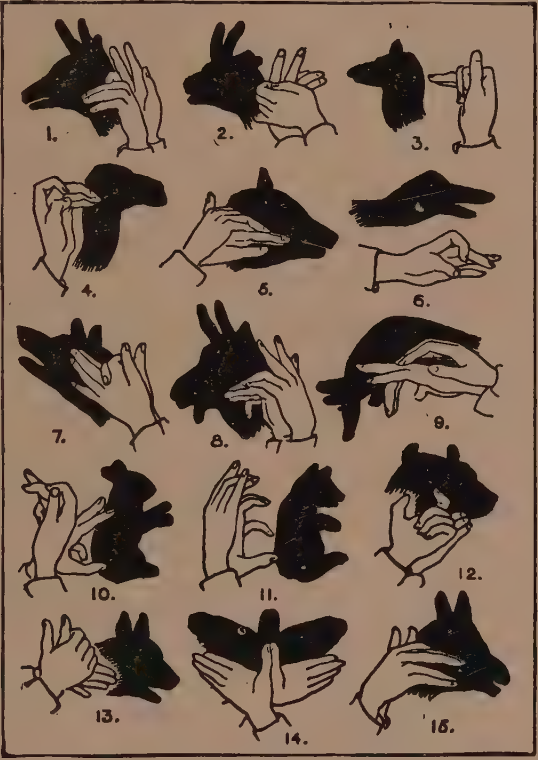
This is how it is done. We hold the watch horizontally, face upward. Then we place some slender article, such as a match or the stalk of a flower, upright against the edge of the watch, and at the point on the rim of the glass opposite the point of the hour hand. By turning about, it is easy to get the watch into such a position that the shadow of the match falls along the hour hand, as seen in the picture. This means that the hour hand is pointing at that spot in the horizon which comes immediately under the sun. The south is exactly midway between that point and the figure XII on the dial. Thus, if it is eight o'clock in the morning when we try the experiment, we know that when we have the watch in the position necessary for the shadow of an upright match to fall along the hour hand from its point, a line drawn from the middle of the dial through the figure X will point to the south. If it is ten o'clock when we make the experiment, then the south will be indicated by a line drawn from the centre of the dial through the figure XI. If it is afternoon the same rule applies, only in that case the point to indicate the south will be backward in time, not forward. If it is two o'clock, the line to indicate south will pass through the I, and if it is four o'clock, the line will pass through the II.

To understand this, we must remember, first, that the sun is exactly in the south every day at noon, so that it takes 24 hours to complete its apparent journey round the earth; second, that the hour hand of a watch takes 12 hours to go completely round the dial, and therefore moves twice as fast as the sun. Now, if at noon we place the watch in the position described, with the hour hand pointing to the sun, evidently the figure XII will be pointing south. Therefore, at any other time, say, four o'clock in the afternoon, we know that the hour hand of the watch has gone twice as far past XII as the sun has gone past the south; so that, as we still have the hour hand pointing at the sun, we must go halfway back to XII to get the south, which of course means that the figure II points south. In the same way, if the time was eight o'clock in the morning, the hour hand will go twice as far before noon as the sun goes before it reaches south, and therefore halfway *forward* to XII—that is, the figure X points south. It is important to remember whether the imaginary line should be placed *backward* or *forward* of XII.

For the sake of simplicity, we have spoken only of exact hours, four o'clock and eight o'clock, but any other time would be equally easy, since it is the hour hand only that we use, and halfway, in one direction or the other, from the hour hand to XII is the south.

THROWING SHADOWS ON THE WALL

THE study of shadows is a very important branch of science. Most of us have seen eclipses of the moon, and if we read books or articles about eclipses we learn that when an eclipse of the moon occurs, what really happens is that the shadow of the earth is cast upon the surface of the moon by the sun, and the shape of this shadow is one of the reasons for believing the earth to be round, or spherical, in shape.



SHADOWS MADE BY THE HANDS ON THE WALL

1. Reindeer. 2. Chamois. 3. Hound. 4. Camel. 5. Pig. 6. Goose. 7. Wolf. 8. Goat. 9. Elephant. 10. Hare. 11. Teddy Bear. 12. Ox. 13. Dog. 14. Butterfly. 15. Donkey.

But, in addition to the fact that there is science to be learned from a study of shadows, it is worth knowing that a great deal of amusement and pleasant recreation may be obtained by casting shadows upon the wall with no other aid than that of the hands. Of course we require good lamp light to throw the shadow, and we need some white or light flat surface upon which the shadow may be cast, but beyond this no apparatus at all is necessary. Practice only is required, and but very little is needed in the way of directions. We must, of course, have our hands between the light and the wall or other surface upon which we wish to throw the shadows; and in the pictures on this page we see a number of shadows of animals that any clever boy or girl can make with a little practice. We should imitate closely the position of the hands as shown in each picture until we get the shadow clearly and correctly. Let us repeat all the different forms over and over again, and after a little while we shall remember the position of the hands without having to refer to the picture. This is absolutely necessary in order to make the performance a success.

Having succeeded in learning to make these various forms, we must next learn to give action to the shadows by moving the fingers or thumbs so that the animals appear to be eating, or moving their ears or legs. Much fun, for instance, can be caused by clever movements of the Teddy-bear shadow. It also adds greatly to the effect if we can imitate the sounds made by the different animals and birds—barking, quacking, grunting, and so on, as the case may be. The shadows shown in the picture are merely a few of hundreds that may be produced by different combinations of the hands and fingers. New forms, or rather additional forms, we shall invent as we become more proficient in making shadows; and it is remarkable how the same position of the hands, or almost the same position, will give entirely different shadows, provided the hands are held at different angles to the light, and a finger or two be moved this way or that, as the case may demand.

Of course the brighter the light, the blacker will be the shadow, and the outline will be clearer or less defined as we move our hands nearer to the light or to the screen or wall. For all ordinary purposes, and for an entertainment given on the spur of the moment, a light wall or blind is quite suitable, but some who are particularly quick and skillful in inventing and producing shadows may like a special screen upon which to give their entertainments. This may be made quite roughly, of any size, by merely nailing or screwing four battens together to form a square or an oblong, and covering the framework, thus built up, with cheap cloth. It would, of course, be quite flat, and would pack away, when not in use, behind a cabinet or chest of drawers. In using a screen, we should, of course, let the audience look upon one side of it, while we stand on the other side, with the light that is to cast the shadows beyond us. The spectators would see the shadows through the screen—that is, on the side opposite to that upon which we are casting them.

Those who are even more ambitious and have the time to spend in which to make a more elaborate screen than the one described, can, if they so desire, improve this by painting upon it curtains, which will give it the appearance of a small stage. This, of course, adds greatly to the appearance of the shadows from the spectator's point of view and also gives a professional touch to the performance, while it really costs very little indeed. But, as explained, no accessories are actually needed.

HOW TO MAKE FANCY KITES

ON page 900 you were given directions for simple kite construction. Here are directions and diagrams for making several fancy models, now that you have been initiated into the make-your-own-kite club.

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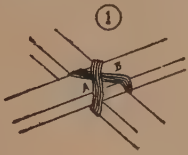

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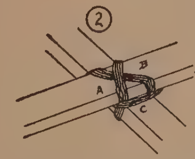
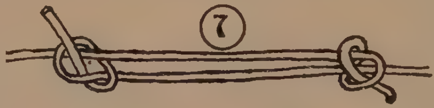


The wood used for these sticks should be light in weight, straight in grain and free from defects. Spruce is splendid, as is soft pine. Other good woods are cypress, basswood, cedar and redwood. Bamboo can be used if you have an old bamboo fishing-pole to split up. Dowel sticks also can be used for splines or for vertical sticks.

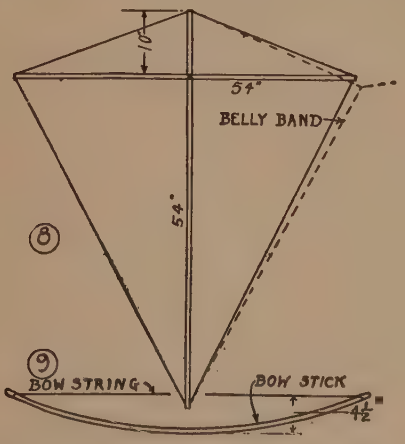
Heavy linen thread should be used for binding together the framework sticks, and strong light-weight wrapping-paper, unbleached muslin, cambric dress-lining, airplane linen or balloon silk are suitable for the covering material. Also, brown wrapping-paper such as is used at the grocery store is entirely satisfactory. For the flying line any strong light-weight wrapping-twine which may be bought at the hardware store will do; however, nothing is better for this than mason's twine.

⑦



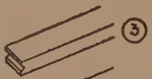
The success of making a framework that will hold its shape lies mainly in the lashing of the sticks absolutely rigid. To any boy scout who is fortunate enough to have passed his knot-tying tests this will be a quite easy matter. After crossing the sticks at the desired angle you should lash them diagonally both ways, as *A* and *B* in picture 1, keeping the thread taut.

⑧ ⑨



Then wind the thread around the lashings between the sticks as shown at *C* in picture 2. The ends of the sticks should next be notched to receive the framing string, as shown in pictures 3 and 4. When the string has been passed through the notches it should be lashed to the stick ends with thread as in picture 5. A checking of the spacing of stick ends can be done, and the necessary adjustments may be made before the lashing of the framing string to the sticks. Notches may be made with a jackknife, a file, a coping-saw or any other small saw. Picture 6 shows how to fasten the framing string to the stick ends by the use of an overhand knot.

③



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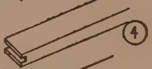

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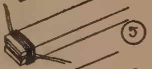

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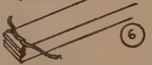


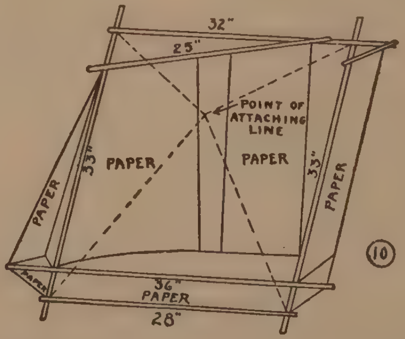
There are different methods of attaching the bridle. The bow kite, as shown in picture 8, has a two-point attachment, as indicated by the dotted lines. In this diagram the bridle has been brought over to one side, to show you how long to make the loop and at what point to join the flying line. Picture 9 shows approximately how much to bend the bow stick.

The ship models, as shown in pictures 10 and 11, have four-point bridle attachments. The point of attaching the flying line is somewhat above the centre of balance. The centre is readily ascertained by balancing the finished framework upon the edge of a narrow board. One ship model shown requires a tail.

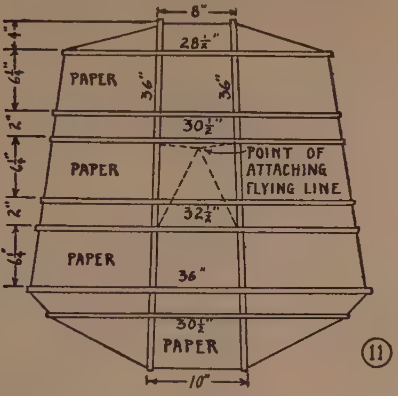
The butterfly kite, as shown in picture 12, has a six-point bridle attachment, with the flying line joined at a point above the centre of balance. The flying line must be securely fastened to the belly-band so that there will be no possibility of its slipping. The fisherman's knot, shown in picture 7, or a similar slipknot, is a good one to use here, as well as for joining one length of line to another. Notice that two overhand knots are made, each embracing the other string. When pulled together they compose a secure knot which can be readily undone by slipping the knots apart and untying.

Paper covering for these kites is best fastened with homemade flour paste. As you experiment with these and other kites various suggestions and short-cuts will occur to you. However, the directions given here should be followed until you are able to devise better.

⑩



If you have seen pictures of Chinese kites you will have noticed many queer shapes. Chinese and Japanese love to make their kites in the forms of dragons, beasts and fishes. Some of the Asiatic kites are very large, as much as seven feet in height or breadth. Once in a while clever kite-makers build into their kites reeds or thin bamboos which give a mournful sound.



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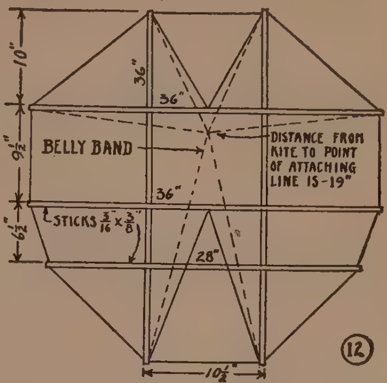

10"
36"
36"
9½"
BELLY BAND
DISTANCE FROM KITE TO POINT OF ATTACHING LINE IS-19"
36"
6½"
STICKS $\frac{3}{16}$"×$\frac{3}{8}$"
28"
10½"

⑫

A BOTANICAL PUZZLE GAME

HERE we have a plant puzzle game in which six plants are correctly described to us, and from these descriptions we should at once be able to name the plants. The right names are given on page 5886.

1. On the southern shore of England, where the tide washes over it every day, among rocks and shells, there lived a little brown plant. It had a root and branches that were tough, quite unlike the hard woody twigs of a tree. It would have liked to grow pretty flowers, but it could not manage that, so it gazed instead at the lovely sea-anemones that lived on a rock opposite. All its life it had dwelt in the same little crevice of a rock. In the hot summer days it used to get flabby and limp in the blaze of the sun, and it thirsted for the cool refreshing water to revive it. When the tide came up it pushed up its branches and waved them in sheer pleasure. A branch once floated on to the sand and lay there till a little boy came along. He picked it up, and "Pop, pop, pop!" it went as he pressed it. What was the plant called?

2. There is a very strange plant growing in a meadow, so strange that one might think it a magic plant. It chooses a funny time to do all its growing, for it grows up in a night. It is a pale white thing, and we have to search quite underneath it near the stem to find any color. There are rich brown plates under the white cap, all placed evenly side by side like the spokes of a wheel. We gather it and eat it for dinner with beefsteak. What is it?

3. There is a trailing wild plant, a native of Europe and Asia, but found also in our own country, which is named from the taste of its root and branches. The name is a contradiction. It is a member of the potato family, and has a typical potato blossom, but its leaves are unwholesome to eat. It is found in thickets and in moist places, and sometimes climbs over walls and bushes, or twines itself round other plants. Its oval berries, at first bright green, when fully ripe become brilliant scarlet, resembling red currants. These are the ripe seed-vessels of flowers which have withered. Can you guess what it is?

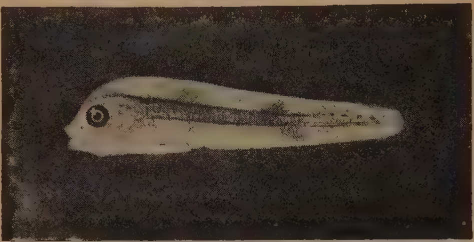
4. Someone gave a brother and sister a slightly flattened, round, brown thing, dry and hard, which reminded them of an onion. The friend who gave it to them asked for a bowl, put some pieces of charcoal in the bottom, then some cocoanut fibre mixed up with broken shell, and buried the dry brown thing in it. "Keep it wet, and put it away in the dark," the children were told. So every day they had a look at the bowl, until at last a light green point began to show through the brown coat. Then they were sure it was a plant, and brought it out into the light and put it in the window for the sun to help it grow nice green leaves. When it was still quite young it sent up a flower-stalk, and as the days went by the buds opened out into beautiful bell-like pink flowers, so sweet-scented that their fragrance filled the room. What was the name of this plant?

5. Millions and millions of just one kind of plant! It takes hours and hours to pass them in the train, and our eyes get dazzled with the golden color. What a wonderful plant! Let us take home a seed and put it in some damp sand. Six days later it will have grown a little hairy root downward and two more are just appearing beside it. Upward into the air it will send a shoot, and about ten days later a leaf will have grown out of this. All the early summer it goes on getting taller. Then it puts forth flowers, though we should hardly know them for such. These produce seeds, and how precious these seeds are! Without them we should go hungry, for they are our daily food. What is the plant?

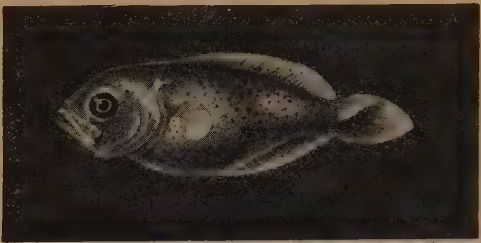
6. On one of the sunny isles of the South Sea is a very tall plant. Its pretty, feathery-looking leaves all grow at the top. Every year it has been growing nice things that are really seeds, sometimes two hundred of them, for the children all over the world, things they like to eat and drink, and make into sweets, cakes and biscuits, and sometimes use for making soap and even for oil for lamps. They are all wrapped round with thick brown coats that are made into matting, mats and baskets. What is the plant's name?

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 5885.

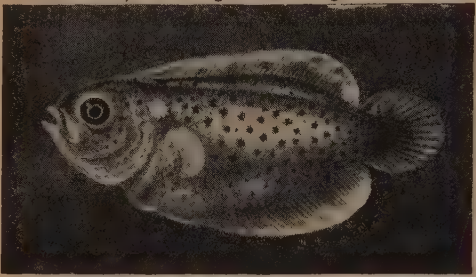
THE AMAZING STORY OF A FLAT FISH



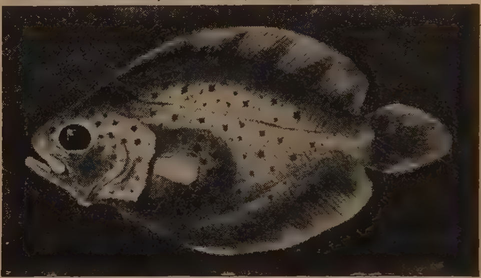
These pictures show the life-story of a young turbot. When hatched from the egg and a day or two old, it is like this, measuring about an eighth of an inch.



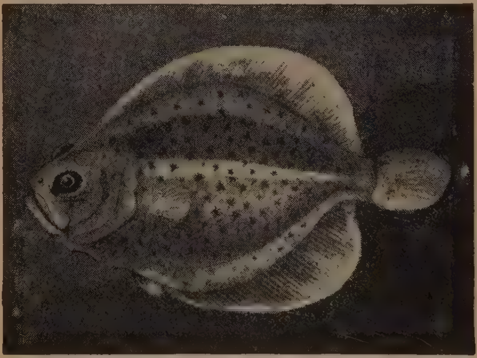
As it grows it changes shape, and when about three-fifths of an inch long it begins to develop spines on the head. These, however, disappear later.



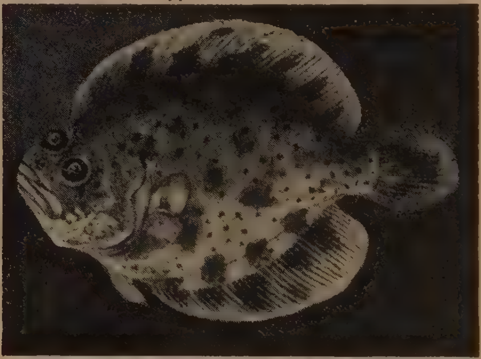
In the early stages of its life it is symmetrical in form, and both sides of its body are colored alike.



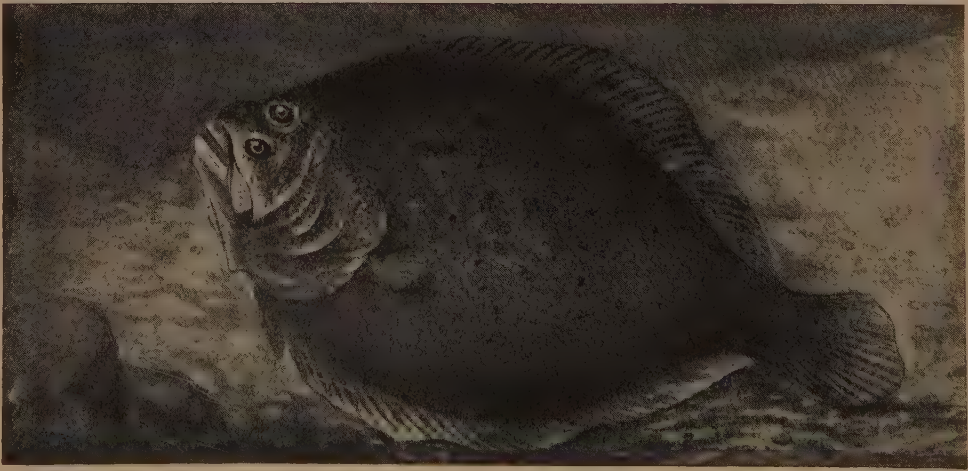
All this time it swims upright, with an eye on each side of its body, so as to see on both sides.



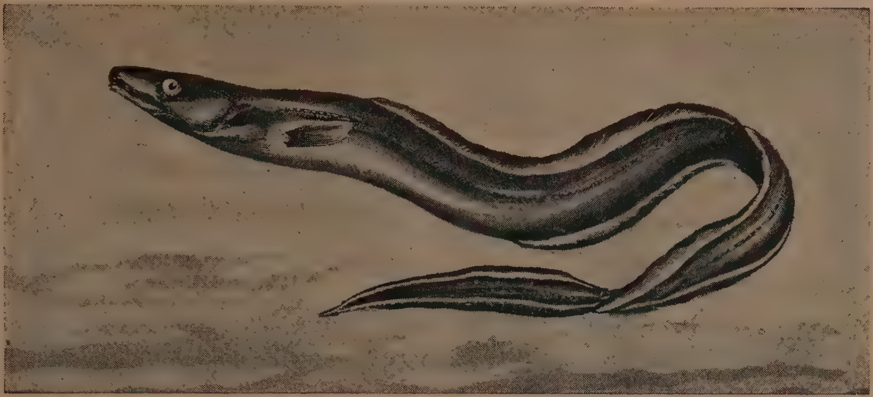
Now an amazing thing happens. One of the eyes begins to travel round the head, as we see here.



It changes its habits, and instead of swimming upright it becomes a flat fish, lying on the bottom.

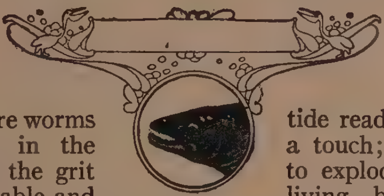


At last the under eye has traveled round to the top side of the fish, and the under-surface becomes white. Other flat fishes change their form and habits in the same remarkable way.



The Conger Eel.

FISHES OF SHALLOW SEAS



WHAT a wonder world it is that lies before us as we stand upon the seashore! There are worms and shelled creatures in the sand and mud, eating the grit and digesting the vegetable and animal matter in it. There are creatures hopping like fleas, creatures to which a piece of seaweed is a living continent; mussels anchored by their own coarse silk to rocks and stones; periwinkles that clatter down the sloping beach when the tide goes out, like sprites in elfin clogs; limpets that gravely march down their rock to feed, and return to exactly the same spot when the tide comes back; and no limpet, for all its perfect accuracy of movement, can see.

There is a crab to catch the moving limpet down in the water. There is a fish to catch the crab. In the warmer waters sponges siphon food-bearing water in and out of their canals; sea-urchins feed and defy capture, thanks to their prickles; starfish open with unaided legs the tight shells of the oyster, though no man can do so with bare hands. Whelks are sawing with their file-like ribbon tongues through the oyster's shell; the sea-anemone swallows the crab which caught the limpet, and the sea-slug and the cod dine on the anemone.

Shrimps and prawns and lobsters are in their pools; cockles in the sands below tide ready to leap like frogs at a touch; brittle-stars prepared to explode into fragments like living bombs if we handle them; living creatures like pens and cucumbers, like lilies and other floral beauties, are in the coastal seas: a rare challenge to the thoughtful mind. They feed in many cases on identical foods, yet each breeds according to its kind. There are things to-day as they were years ago, now turned to fossils which we dig up whenever we excavate the limestone and chalk.

But we must concern ourselves with fish alone, and they have ways and wanderings which perplex the wisest of naturalists. Seeing how important fish are to us, it might be thought that we should by this time know all there is to be known. The truth is, we know very little. Empires have been founded on the herring. The cod, not gold or tales of fairy lands, brought some of our mariner forefathers across the cold Atlantic to fish with bleeding, splitting hands on the Newfoundland banks.

But we do not know all about these fish. We do not know where the herring go when they leave our shores. We do not know where the teeming mackerel spend their winters. We do not know why fish assemble in the billions in which from time to time they appear. We do not even know what all fish eat. They rapidly absorb their food, and when caught, cast it up, either from fright or like a laboring ship which throws its cargo overside to lighten sailing.

MYSTERY SURROUNDS THE MOVEMENTS OF FISHES

We do not know why fish should be capricious, and, having created the fortunes of a town founded on them, desert the waters in which they had abounded and vanish. The sea to which we go for pleasure and health is a domain of mystery which men have been sounding for thousands of years without having touched the depths of knowledge.

In normal times fisheries employ, directly and indirectly, a considerable part of our population. There are in good times thousands of men engaged in fishing, and, whatever their returns to-day, their catches before the World War were worth many millions of dollars every year.

Perhaps we should begin with sharks, but we shall leave them for the next chapter and shall now speak of the shark's kindred, the monkfish and the rays.

The Monkfish, or Angel-fish, is a connecting link between the sharks and rays. This is a hideous brute which lies at the bottom of the water of warm seas. It is invisible in sediment, though five feet long, with a gaping mouth armed with formidable teeth. In addition to multitudes of flat fish, it cracks up lobsters and swallows whelks. The mother fish produces her young alive, twenty at a birth. Very thankful are fishermen when these fishes are caught and put out of the way, as the men say.

HOW THE SKATES SWOOP DOWN ON THEIR PREY

The Skates, or Rays, about our coasts number upward of a dozen species. They are not much smaller than the monkfish, and, like that animal, are ugly, flattened, variously armed with thorns and prickles on the back, as in the Thornback, and with a deadly mail of spines on the whip-like tail. Sluggish in habit, they live largely on shellfish, oysters, mussels, and what not. They also float above other fishes, then swoop on them, surround them with their flapper-like pectoral fins, and devour them.

The so-called Devilfishes of warmer waters belong to this group. They are known to science as Eagle-rays, fish fifteen feet long, which lash out with their muscular tails all barbed with spines from which a rank poison is said to exude. These are rarities in temperate seas, but fishermen in southern waters know them to their cost and loathe them. The power of the eagle-rays to poison is sometimes questioned, but there is no doubt as to the virulence of the Sting-rays of the tropics, which carry poisonous spines seven and eight inches long on the tail, and cause great pain when they strike human flesh. Some of the family are eaten by Europeans, but not often in this country.

We have another northern species of ray which is as interesting as any ray of the whole family, the Torpedo. All the family may have some slight power to give electric shocks, but the torpedo has developed the gift exceptionally. Here is a lowly creature of our inshore deeps, measuring but little and weighing never more than 150 pounds, which has mastered the mystery of the natural electric battery.

The one thing human electricians have not given us is an efficient storage battery: our batteries are always running down. But this humble fish is constantly fully charged without effort or apparent expenditure. A flick of its tail and the fish at which it aims is stunned; and though the torpedo has poor teeth, it has been known to kill and swallow a five-pound salmon. Nature has her own dynamo, we see, and it works perfectly in this ugly fish of our waters.

THE MOTHER-LOVE OF THE TERRIBLE TORPEDO RAY

Nobody likes the rays, and this one is hated perhaps more than the rest. But there is something to be said in its favor. It does realize that it has the power of a giant and restrains itself in the presence of its own. It never emits a charge from its battery when its young are near, lest it should kill them.

It is pleasant to pass from these unlovely fish to handsome coursers which make life seem gay instead of gloomy and horrid near the shore. We have not to go far out to find the gallant Striped Bass, or Rockfish, a perch-like beauty which, though commonly a one- or two-pounder to anglers on the piers and rocks, runs to fifty pounds or more when left to mature. A specimen weighing over a hundred pounds has been taken off Cape Cod. Like the salmon, it comes up the rivers to spawn. In the St. Lawrence it comes at least as far as Quebec. It is a swift, gay fish, but to the sand eels, which constitute a considerable part of its food, it must seem as frightful a thing as a man-eating shark is to a human child.

There are various sea fish more or less related to the bass and sometimes classified in the same group. They are sometimes called Sea Breams. Some weigh as much as ten pounds. A curious and pathetic evidence of the amazing tenacity of life in fishes has been proved by the breams.

For years examples were caught which seemed to possess no upper jaw, though there was no sign of wound. Long research proved that the fish when young were caught nibbling at a bait and were hooked with such violence that their upper jaws were torn away. Yet they survived, healed their hurts, grew great and fat, with half their mouths missing, and in the end came to table.

THE MULLETS AND THE FIERCE BLUEFISH

The Mullet Family is a large one and is found in the shallow waters of the warmer regions of the world. Some species live in fresh water. The Common Mullet is really common on our side of the Atlantic south of Cape Cod. It feeds entirely upon what it finds in the mud of bays and lagoons, and is an excellent food fish. The White, or Blueback, Mullet is found in the same waters, but is less common. The name "mullet" is also incorrectly applied to many fresh-water fish, especially of the Sucker Family. The European Red Mullet belongs to another family. It was much prized by the Romans and is considered a delicacy to-day. Our Red Mullet, also called the Red Goat Fish, is much like it, but is not very abundant.

The Bluefish is the only member of his family, for which other fishes may be thankful. They range the western Atlantic and the Indian oceans like hungry wolves, apparently killing for the joy of slaughter. They do not hesitate to attack other fish almost as large as themselves, eat a few choice bits, and go on to kill others. Fortunately they are among the best of food fishes, and when you eat one you are saving the lives of hundreds of other fish.

The next group is the gorgeous mackerel—for gorgeous they are in the sea and when newly drawn from it. There is not a more perfect fish in the waters, blue and black and olive and silver. They sail the seas with the pace of the fastest destroyer, and half their lives are mystery impenetrable to us.

THE GREAT MACKEREL SHOAL THAT WAS FIFTY MILES ROUND

Why do they shoal in such countless millions? They break up at times into single units and are caught in deep water quite isolated. At other times they are countless. One ship steamed round a shoal fifty miles in circumference, and that was only one shoal of many on the move in the North Sea at the time. So tightly are they packed together that once a great grampus, which follows a mob of seals and eats twenty in succession, was seen practically suffocated by the enormous pressure of mackerel into which he had ventured. The mere weight and mass of the racing fish prevented his rising to the surface to breathe.

But toothed whales, sharks and cod and other hungry creatures follow the mackerel with safety, browsing on them as a cow on grass. If the fish were swimming singly, the big enemy could not thus destroy them.

About fifteen of the sixty species frequent American waters. The Common Mackerel inhabits the whole North Atlantic, and some of the finest fishing vessels seek for them. The Spanish Mackerel does not usually go so far north. It is more slender, but is unmistakably a mackerel, and is perhaps the most delicious of the family. Belonging to the same family is the Tuna, or Tunny, also called the Horse Mackerel. It may reach a length of ten feet and a weight of a thousand pounds or more. It is a game fish, and a fisherman who has landed one after a contest lasting for hours feels well repaid. The Bonitos, found in both Atlantic and Pacific, are other members of the family. When the latter takes the hook it sometimes leaps ten feet out of the water in its struggles.

THE MILLIONS OF HERRINGS THAT COME TO OUR COASTS TO LAY EGGS

The shoals of the Herring are still more numerous in point of individual fishes and total of shoals. They surge up to the land in swarms beyond calculation. It is thought that some shoals contain at least three billion fish.

The herrings are a fascinating mystery. Why do they arrive in successive shoals? Why not all at the same time? Have those which come late farther to swim in from distant ocean deeps? Or is it that the desire to lay their eggs does not ripen till later? And where do they go after they have spawned? Nobody can tell.

The Herring Family is interesting and important. While the Common Herring is probably as abundant in our waters as in European, the fishing is not so important, as our fishermen prefer to seek larger fish. In many parts of Northern Europe a good herring year means prosperity, while a bad year means misery. They are caught in nets, and many of the young are packed and sold as sardines. The California Herring, abundant along the Pacific coast, closely resembles its Atlantic relative.

The true Sardines, however, belong to the Herring Family. They are common in the European Atlantic and in the Mediterranean. Indeed, its name comes from the island of Sardinia. They are also called Pilchards in Europe, and the young packed in oil come to us from across the sea. The California Sardine, abundant in the Pacific, is a true sardine.

Most of the herrings spawn in the open sea, but the one we who live near the sea know best, the Alewife, is anadromous (ascending). In early spring all along the Atlantic coast from the Carolinas northward this little fish enters the streams in thousands to lay its eggs. It is good food, and artificial pearls are made from its scales. Somehow it has managed to get into Lake Ontario and other lakes near the St. Lawrence, and there it lives all the year.

THE SHAD BELONGS TO THE HERRING FAMILY

Perhaps the most delicious of the herrings is the Shad. There are two European species, but our American Shad is more important. This fish enters the streams from Florida to Newfoundland to lay its eggs. Formerly it was one of the commonest and cheapest of fish, but the fishermen put so many nets in its way, and the factories have so polluted the streams, that it has become scarce and expensive. The United States Fish Commission years ago set free many young shad in the Pacific waters, where the fish was not common. They thrived and have become common as far north as Alaska. The only drawback in eating shad is the multitude of tiny bones. The roe taken from the female fish before she has had the opportunity to lay her eggs is a great delicacy.

We can mention only one or two more members of this interesting family. The Sprat of which you read is a small European herring which is salted or smoked. The Menhaden is abundant from Nova Scotia to Brazil. It is probably the most abundant of all our shore fishes. It is not worth much for eating, but it feeds other fish, makes good bait, furnishes a valuable oil, and what is left is good fertilizer.

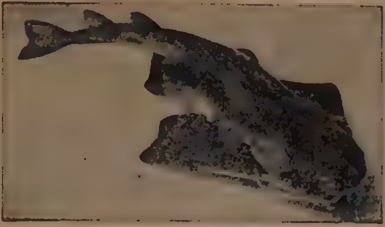
There is another group of small fishes which is much prized, the Smelt Family. They resemble the trout in many ways. The Capelin lives in Arctic waters, and its eggs in the spawning season sometimes cover the shores. The Eulachon, or Candlefish, found on the Pacific coast is so fat that when dried it is sometimes used as a candle. The true smelts are found both in the Atlantic and in the Pacific, entering rivers to spawn. Captain John Smith wrote in 1622: "Of smelts there is such abundance that the Salvages doe take them up in the rivers with baskets like sives." In the East they are often found comfortably living in lakes.

SOME OF THE FISHES WITH SHARP SPINES

We mentioned the spines of the stickleback in speaking of fresh-water fishes. The sea has many with this means of defense. The Weevers are European fish, and are dangerous to handle because of their sharp spines. The Gurnards, chiefly European, and the Sculpins, or Sea Robins, are hideous in appearance except for their coloring, which is sometimes attractive. You will find some of them shown in our colored plates in this chapter. The Gurnard is supposed to get its name from a French word for "grunt."

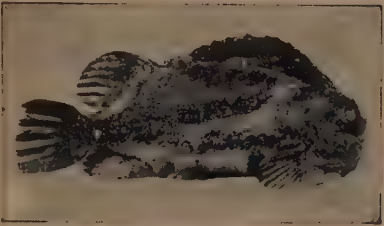
Other curious fish are the Gobies, which build nests. After the female has laid her eggs the male watches until they are hatched. The Blenny Family is hardly less interesting, and the members can live out of the water for a considerable time. The Lumpsucker is so

FISHES CAUGHT IN SHALLOW SEAS


Angel-fish, or Monkfish.

Sea Horse.

Common Cod.


Lumpsucker.

Red Gurnard.

Wrasse.

Red Mullet.

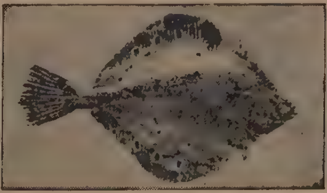
Mackerel.

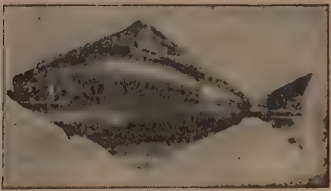
Greater Weever, or Sting-bull.

Hake.

Whiting.

John Dory.


Plaice.


Halibut.

The pictures on these pages are by W. S. Berridge and others.

devoted to its eggs that it will remain half exposed if the tide runs out, though sea birds approach to eat it.

THE CHARMING LITTLE SEA HORSE

The sea also has its faithful Sticklebacks, the fifteen-spined; and not far from the haunts of these we find the Pipefish and the Sea Horse, which are as careful of their eggs as the lumpsucker and the stickleback. The Pipefish floats at ease in a straight line; the Sea Horse, so called from the extraordinary resemblance of its head to those old Greek carvings of horses with which we are familiar, has a tail which is as good a grasping organ as the monkey's. It is not much over three inches long.

By its aid the sea horse anchors itself to weeds and other objects and lets food come to it. But it has this in common with the pipefish, its kinsman: like one of the frogs, the sea horse and the pipefish receive the eggs from the female into a brood pouch and keep them there till the babies emerge. In time of danger the little hopefuls return, like baby kangaroos, to the pouch from which they emerged.

Next we come to a very different fish, the Conger Eel, more often seen in shops than by visitors to the seaside. Generally it keeps well out from shore in deep, rocky water by day and comes toward the coast, if at all, only in the night. Seen in the water, a conger six or eight feet long and weighing up toward a hundred pounds must often have given rise to legends of sea serpents. A large female conger is known to have laid over three million eggs. Like the fresh-water eel, they die after spawning once.

A DIVER'S ADVENTURE WITH A GIANT CONGER EEL

Their active movements, their snake-like shape, their courage and ferocity, all combine to further the idea. An experienced diver who was repairing the foundations of an old sea-wall was horrified to see the head of a huge creature, which he mistook for a snake, dart out from the wall at him, then as rapidly withdraw. Examination showed that it was a mighty conger trapped in the masonry. By some means it had got into the wall and could not get out.

In general, divers fear congers next to octopuses and sharks, for these eels, once they fix their teeth in an object, will not let go unless they are killed, and even then the jaws have to be pried open. The writer rowed home a mile or more in a storm with a fifteen-pound conger in the boat biting the heel of his shoe with the tenacity of a bulldog.

However, they are clean-feeding creatures, much more particular than the river eels, and they form a valuable food to enormous numbers of poor people in Europe. They are little eaten in this country. They themselves eat great numbers of crabs, lobsters and fish.

Now let us come to the interesting flatfishes. The Rays are not, properly speaking, flatfish, for they have the back uppermost and the abdominal features beneath, as in the case of reptiles. But the true flatfishes are, every one of them, freaks made permanent. They all begin like other fish, vertical swimmers with a left side and a right side, swimming as upright as herrings, with one eye on one side of the head and the second eye to balance on the opposite side. Early in life these fishes begin to topple over. They flatten out, lying on the side, and the head becomes twisted so as to bring both eyes on the same side. Sometimes one eye makes its way through the head.

THE SLUGGISH CREATURES THAT MOVE LIKE SUBMARINE RAFTS

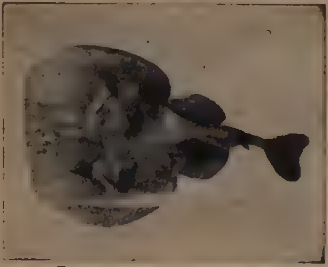
From that time forth the flatfish is a sluggish flopper. Its home is at the bottom of the water, and it moves only by undulating motions, no longer capable of the darting flight through the sea common to its children and to nearly all other kinds of fish.

This Flounder Family is a large one, nearly five hundred species in all, and some of them are found in all seas. They are usually divided into halibut, flounders and turbots, but many of them are called by different names.

The Halibut proper are fish of the colder waters of the North and are often caught in waters close to the freezing-point. The name means "holy flounder," from the fact that it was commonly eaten on special days set apart by the Church. The Common Halibut is found both in the Atlantic and in the Pacific. It is the largest of the flatfishes and may reach a weight of five hundred pounds. The smaller Arrow-toothed Halibut is common in the Pacific, while the Greenland Halibut is found only in the Atlantic. The under-side of this species is somewhat colored, showing that it probably swims more like an ordinary fish. Several smaller fishes called by various names are closely akin. For example, the Summer Flounder belongs to the group.

The true Flounders have most of the teeth on the blind side. The Common, or Winter, Flounder is next in importance to the halibut. It ranges the Atlantic as far south as the Carolinas. The Great, or Starry, Flounder is the important Pacific species. There are several others. We have only one of the true Turbots, a small fish, which is closely related to the European Turbot.

Belonging to one or another of these groups are many smaller flatfish, but their names are very confusing. The true Plaice is European, but the name is used in America for several slightly different fish. The Brill is European. Several different fish are called Dabs both in Europe and America. The true Sole belongs to a closely related family and is not found in American waters, but with us several flounders are called Soles.


Torpedo, or Electric Ray.

Brill.

Skate.

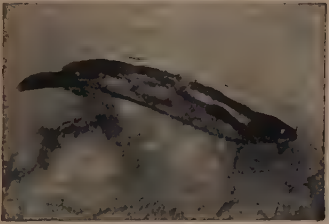
Great Pipefish.

Fifteen-spined Stickleback.

Sea Bream.

Dab.

Haddock.


Five-bearded Rockling.

Bass.

Sardine, or Pilchard.

Whitebait.

Herring.

Sprat.

Now we come to one of the most important families of all, the Cod, which includes pollacks, true cods, tomcods, haddocks, hakes, whitings, lings and burbots. The two last-named live in fresh water, but the family generally inhabits the northern seas of the world. About 140 species are recognized, but only a few are important.

The Common Pollack is found on both sides of the Atlantic as far south as New York and France. It is seldom more than three feet long and is excellent food, though it destroys many other fish. The Alaska Pollack is the common Pacific form. The Tomcod is a miniature cod which is seldom more than a foot in length, and its habits are similar. There is an Atlantic and a Pacific species.

The Common Cod is found over the North Atlantic, and some students think that the Alaska Cod is the same fish and not a separate species. Search for the cod has trained some of the hardiest seamen in history. In fact, the men trained on the fishing-banks of Newfoundland formed a considerable part of the force which defeated the Spanish Armada. The fisherman of to-day is equally hardy. You will find in Kipling's stirring story Captains Courageous a thrilling account of their lives.

The Cod eats everything—birds, fish, crustaceans, molluscs and vegetation. It swallows the molluscs whole, and many rare shells were first found in the stomachs of cod. Other queer things have been found in the stomachs of cod, such as scissors, a boot-heel, an oil-can, corncobs, and even finger-rings.

Though cod over six feet long and weighing over two hundred pounds have been caught, such large specimens are very rare, but specimens weighing up to fifty pounds are not uncommon. A large female may lay up to ten million eggs, which rise to the surface and float on the water. If any considerable proportion hatched and grew up, the sea would soon be packed full of cod.

As a matter of fact, so many are eaten by other fish and by birds, and so many wash up on the shore, that it has been feared that the cod would become scarce. Fortunately the eggs are easily collected, and the United States Fish Commission has set free hundreds of millions of young cod. While most of these were probably eaten by other fish, it is certain that many do escape the many enemies of their youth. The cod is often eaten fresh, but more often is dried and salted. From the liver an oil is obtained which has a great reputation as a remedy in tuberculosis and other wasting diseases. It is very unpleasant to take, as some of you know.

The Haddock is smaller than the cod and feeds largely on molluscs. It is abundant on both sides of the North Atlantic and is often smoked. Some of you know "finnan haddie," which is haddock used in the manner of the village of Findon, in Scotland. Fish of two different families are called Hake. One belongs to the Cod Family and the other resembles a cod. We have both. The name Ling is also applied to the former. The European Ling is a salt-water fish of the Cod Family, and to add to this confusion in common names, we usually call a member of the family which lives in some of the lakes of Canada and the United States by this name. It is almost, if not quite, the same fish as the European Burbot. Other names are Lake Lawyer in this country and Eel-pout in England.

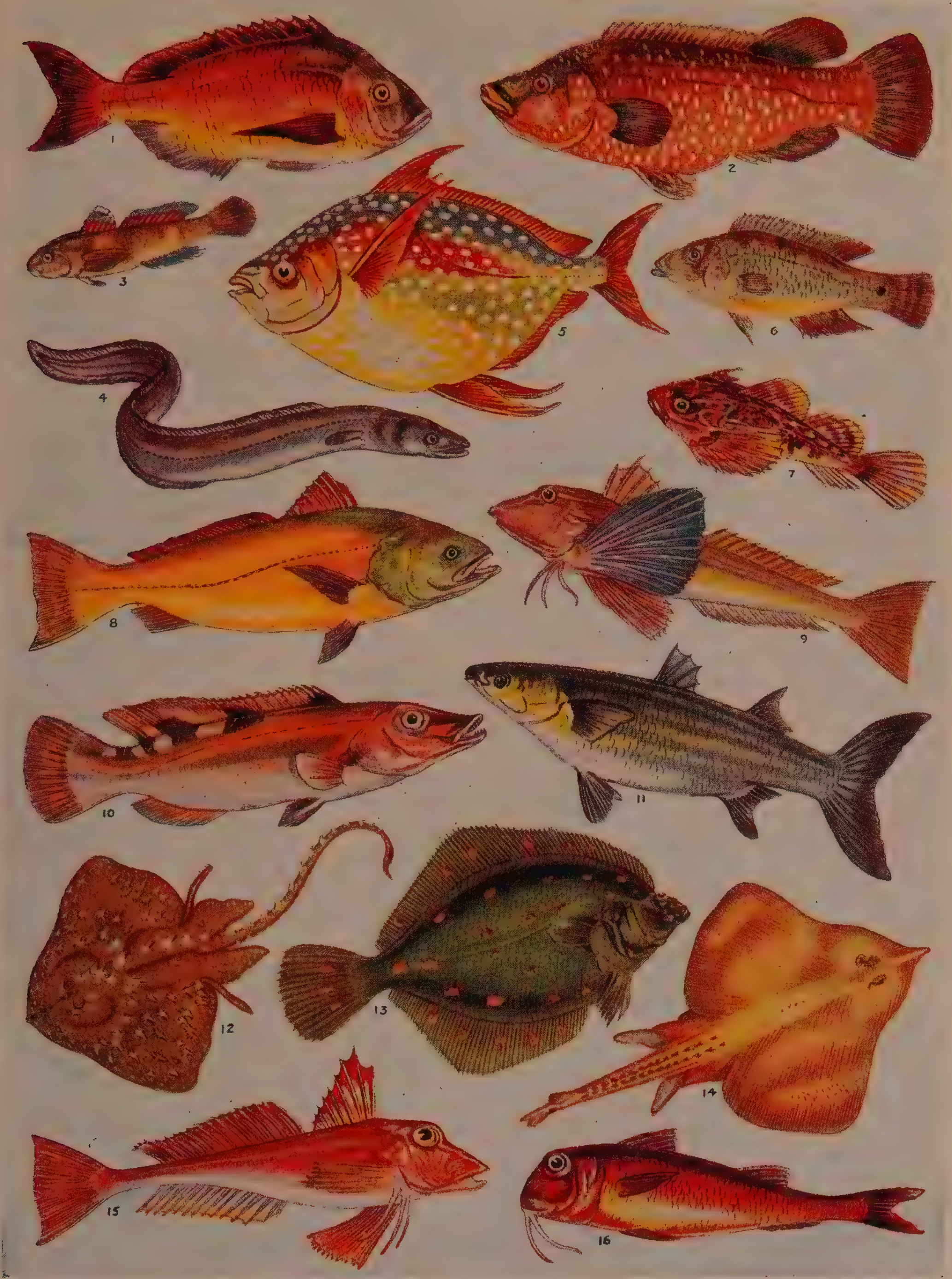
There are many other fishes we should like to mention. There is the Pompano, found only in southern waters, which some think is the best of food fishes. The large Snapper Family is also confined to the southern waters of the world. America has about twenty species, generally bright in color, and all good to eat. The Red Snapper is often seen in city markets. The Porgy Family is another group of southern fishes, though a few do wander northward. The Scups and the Sheepheads belong to this family. They are good food fish.

Several members of the Croaker Family range as far north as the Bay of Fundy. The Common Weakfish, also called Squeteague and Sea Trout, is the best of the family; except perhaps the California White Sea Bass, which is found as far north as Vancouver. The Croaker proper is common along the Atlantic coast. The Kingfishes, also of this family, are generally called Whitings, but the true Whiting is a European fish of the Cod Family.

About 12,000 species of fishes are known, and over 3,300 of them live in American waters north of the Panama Canal. Two distinguished scientists, Jordan and Evermann, tell of American fishes only in a work of four volumes and over 3,300 pages; so you see that if we are to tell you of other things, we cannot tell you of all the fishes.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 5893.

FISHES OF THE NORTH ATLANTIC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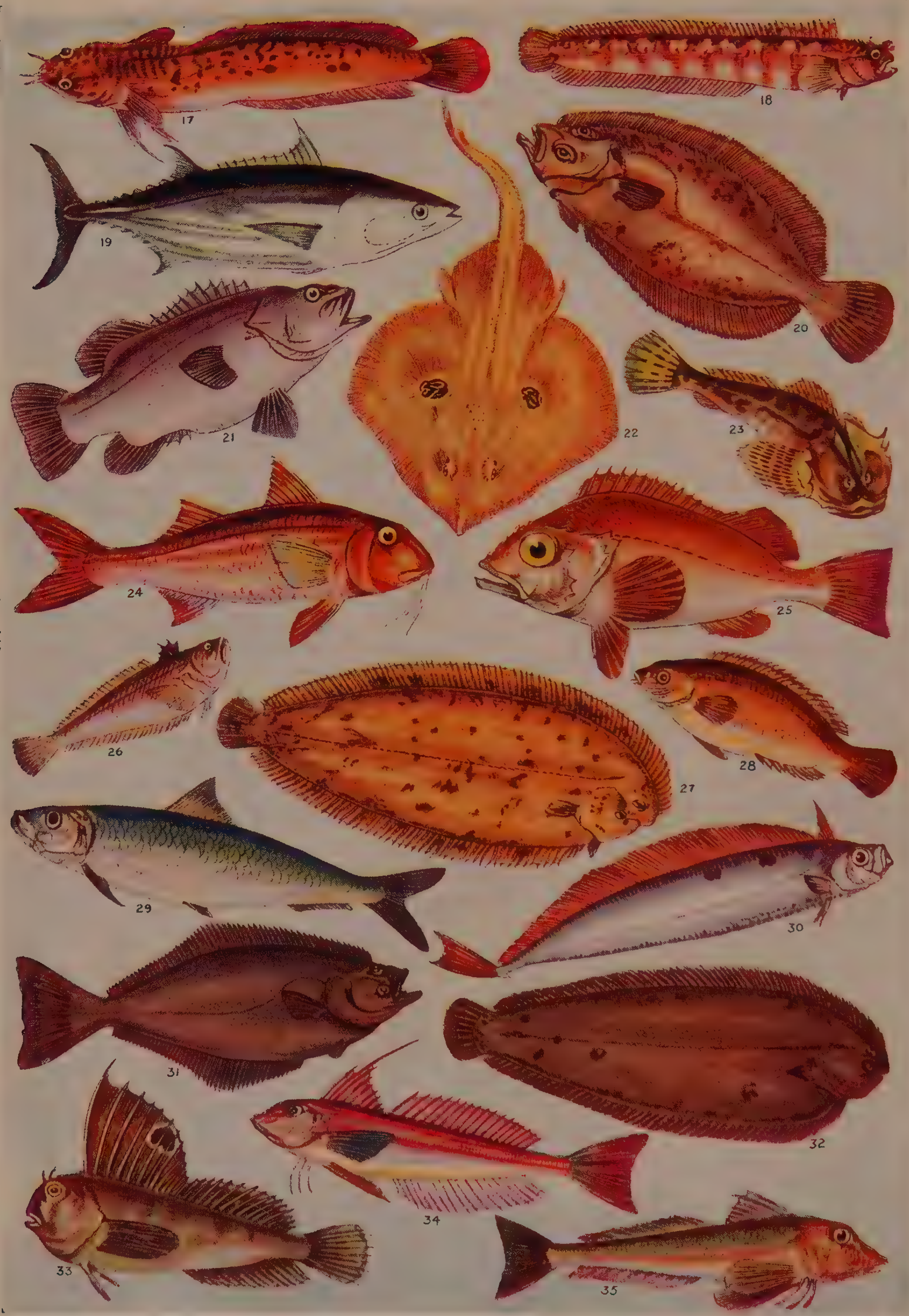
1. Becker. 2. Ballan Wrasse. 3. Paganellus. 4. Conger. 5. Opah. 6. Corkwing. 7. Bubalis. 8. Sciæna. 9. Tubfish. 10. Three-spotted Wrasse. 11. Gray Mullet. 12. Starry Ray. 13. Plaice. 14. Shagreen Ray. 15. Elleck. 16. Red-Mullet.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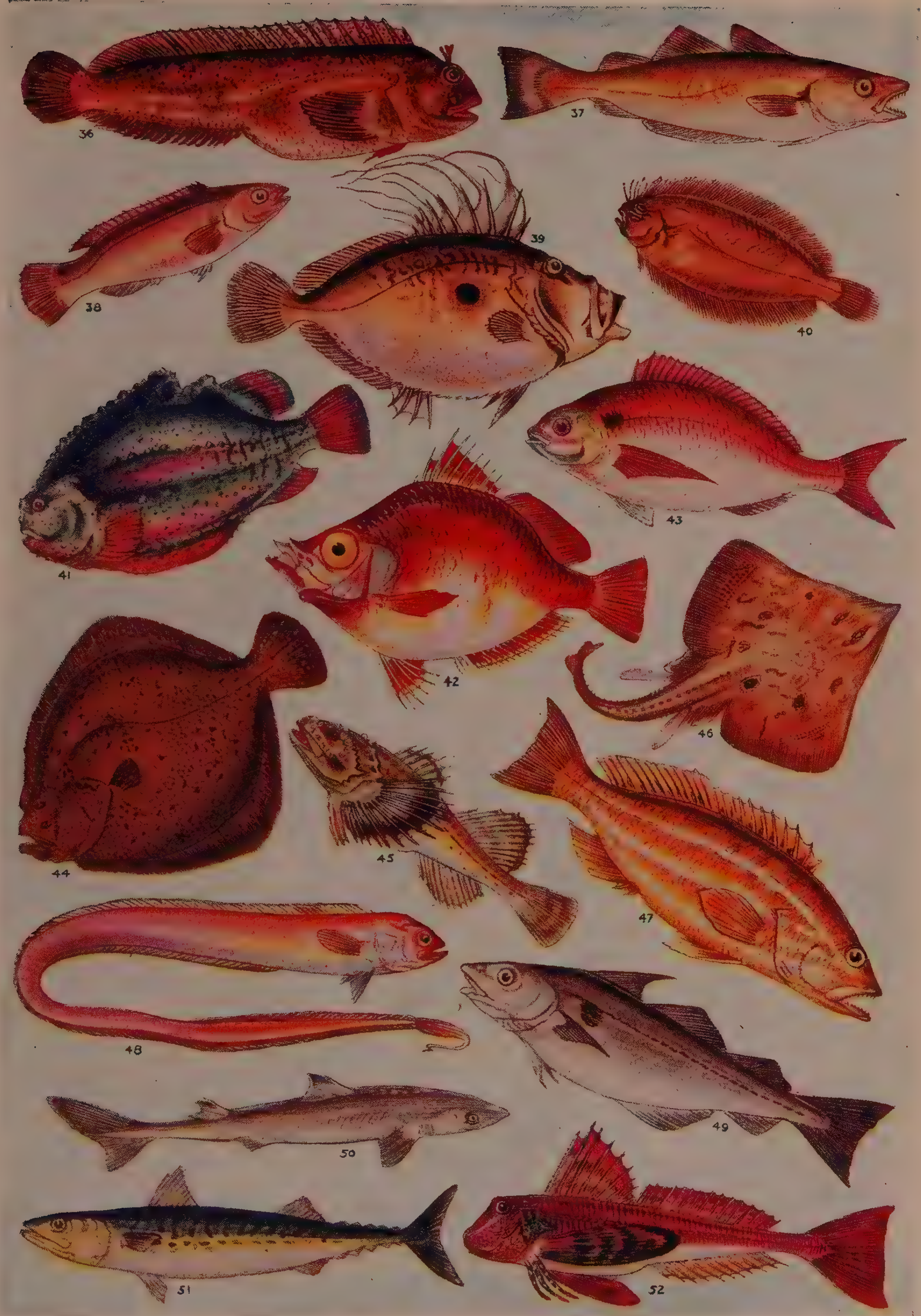
17. Three-beard Rockling. 18. Yarrell's Blenny. 19. Bonito. 20. Carter. 21. Stone Bass.
22. Cuckoo Ray. 23. Father-lasher. 24. Surmullet. 25. Bergylt. 26. Viper Weever.
27. Lemon Sole. 28. Rock Cook. 29. Pilchard. 30. Dealfish. 31. Halibut. 32. Sole.
33. Butterfly Blenny. 34. Lanthorn Gurnard. 35. Gray Gurnard.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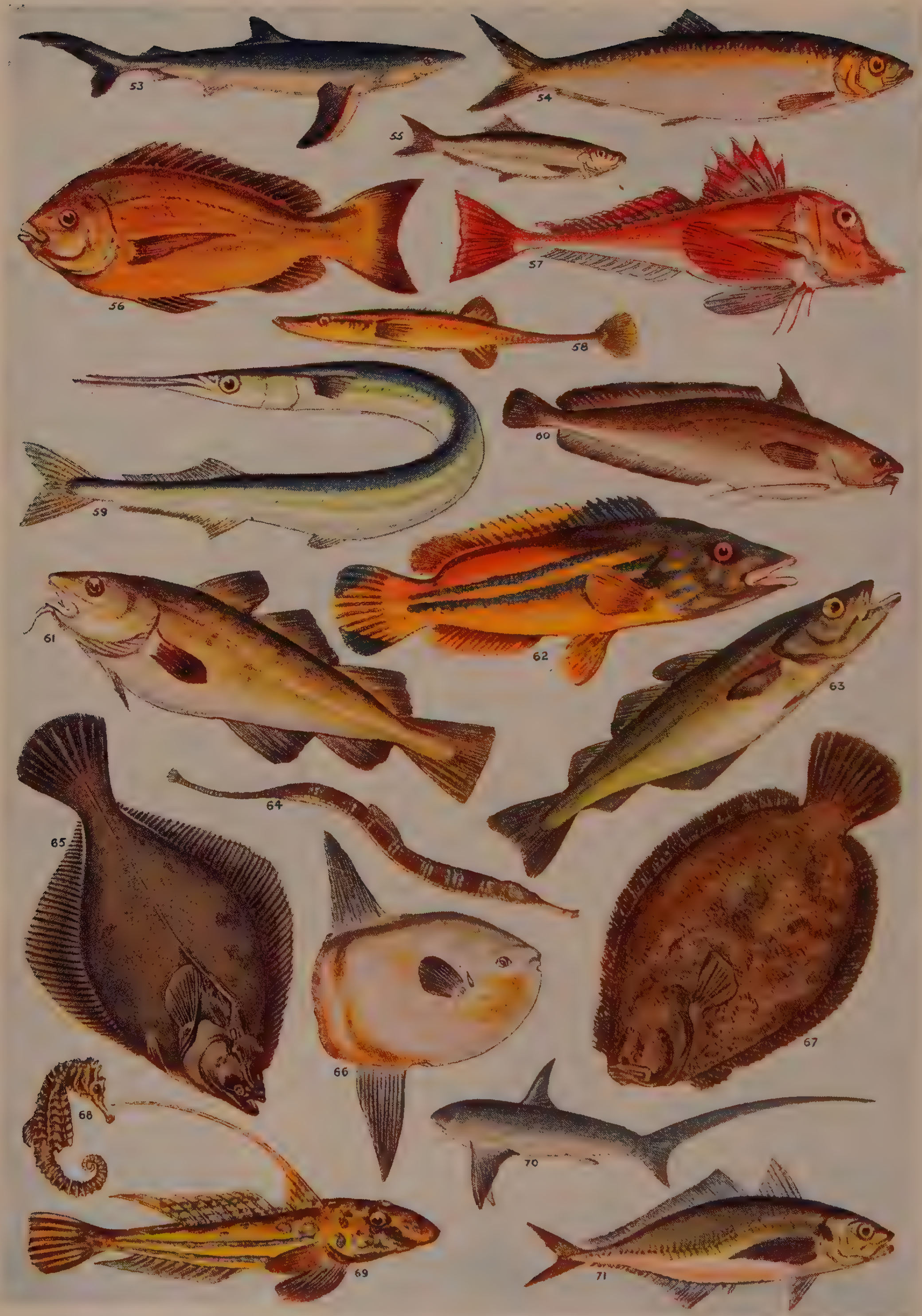
36. Tompot. 37. Whiting. 38. Jago's Goldsinny. 39. Dory. 40. Scaldfish. 41. Lumpfish.
42. Boarfish. 43. Sea Bream. 44. Turbot. 45. Four-horned Cottus. 46. Skate. 47. Comber.
48. Red Bandfish. 49. Haddock. 50. Common Dogfish. 51. Mackerel. 52. Streaked Gurnard.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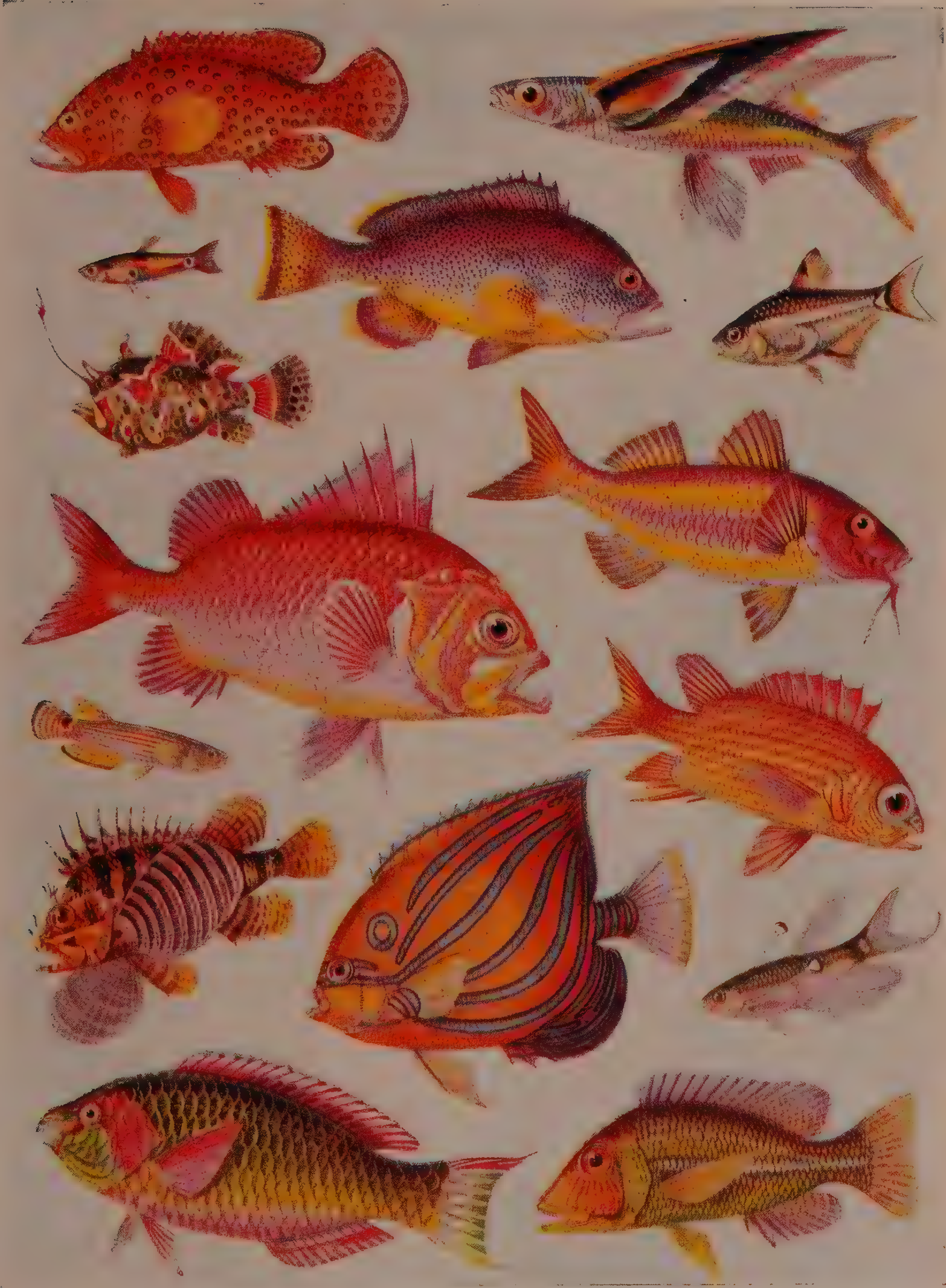
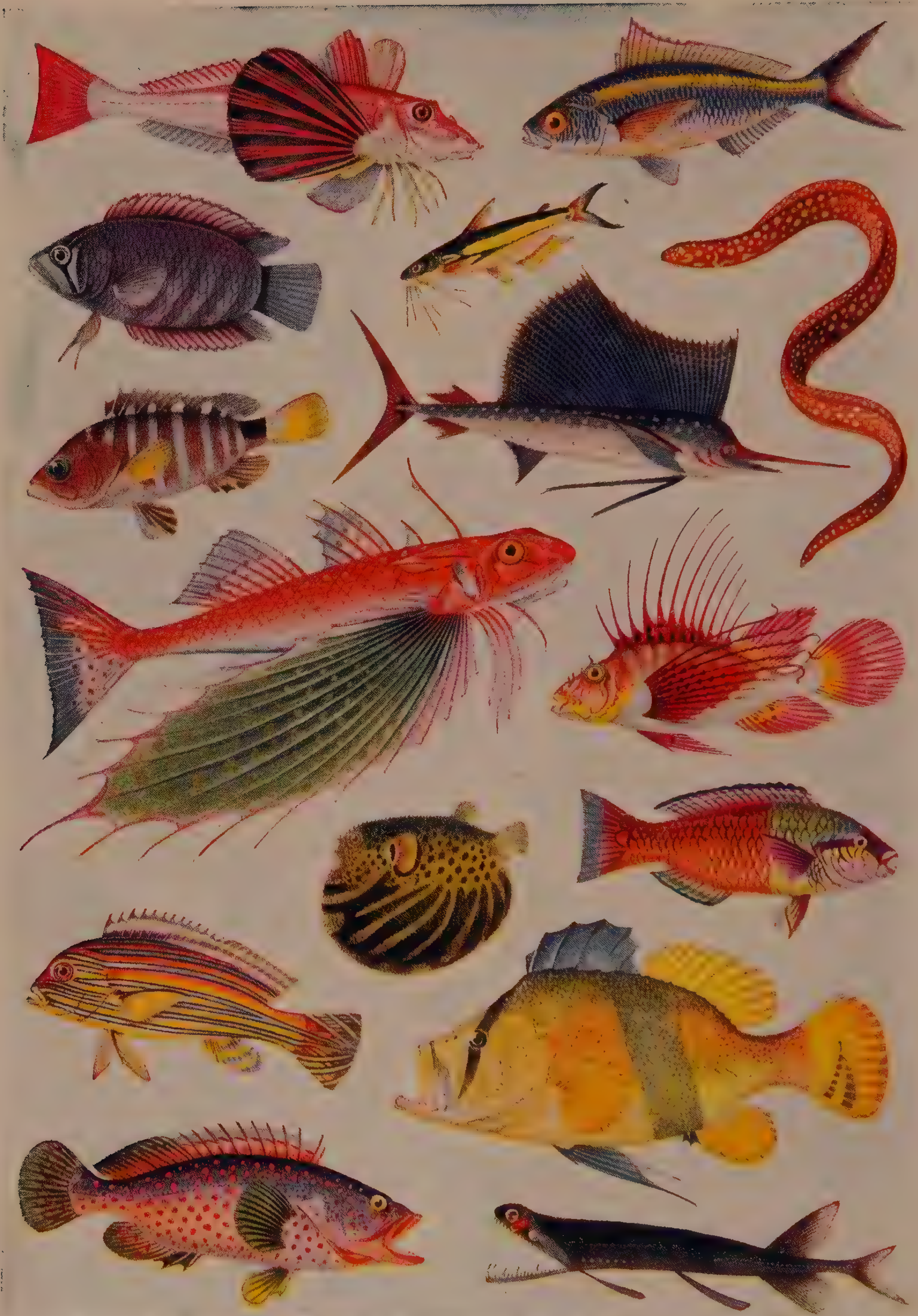
53. Blue Shark. 54. Herring. 55. Sprat. 56. Black Sea Bream. 57. Piper. 58. Fifteen-spined Stickleback. 59. Garfish. 60. Greater Forkbeard. 61. Cod. 62. Cuckoo Wrasse. 63. Pollack. 64. Greater Pipefish. 65. Flounder. 66. Sunfish. 67. Brill. 68. Sea-horse. 69. Yellow Skulpin. 70. Fox Shark. 71. Scad.

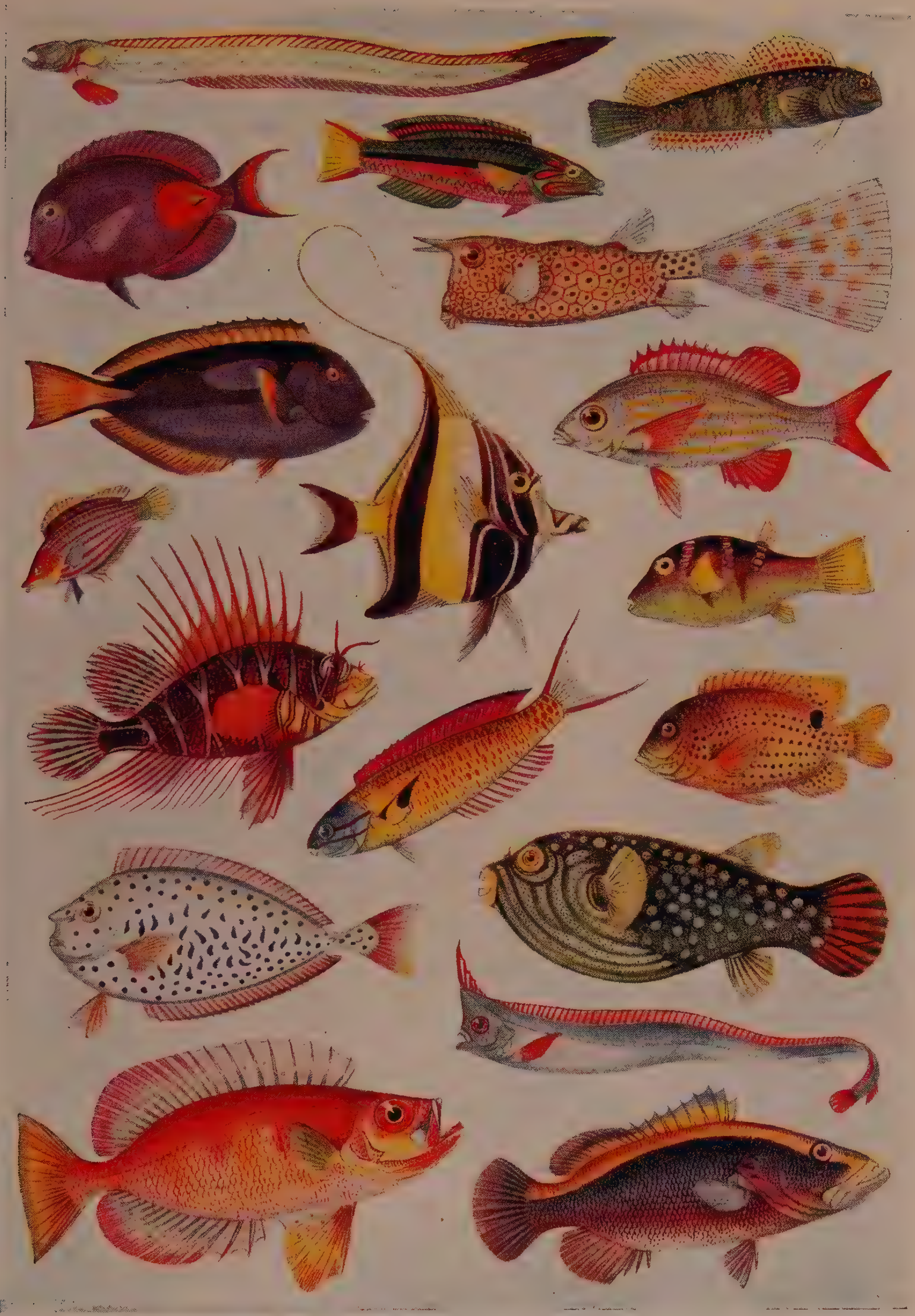
FISHES CHIEFLY OF THE WARMER SEAS



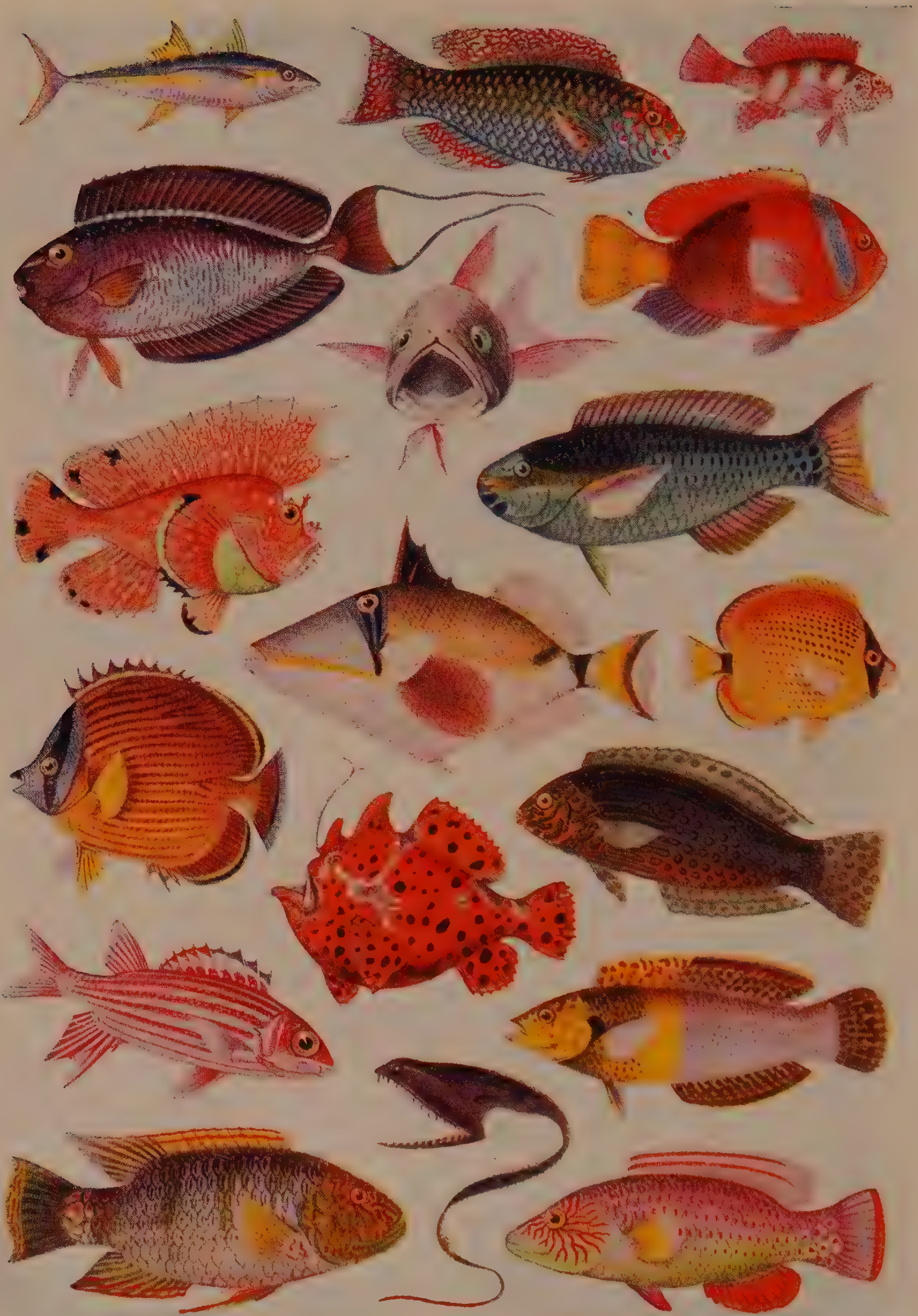
Most of these fishes belong to tropical waters, though specimens occasionally venture northward and a few northern species are represented. From left to right they are: Sea Bass; Four-winged Flying Fish; Guppy; Sea Bass; Characin; Frogfish; Deep-water Squirrel Fish; Goatfish; Rivulus; Squirrel Fish; Poison Scorpion Fish; Ringed Angel Fish; Characin (Stevardia); Parrot Fish; Porgy.



From left to right these fishes are: Gurnard; Cassio; Nandid; Sea Catfish; Spotted Moray; Sea Bass; Sailfish; Flying Gurnard; Poison Scorpion Fish; Swellfish; Parrot Fish; Striped Diagramma; Diploprion; Sea Bass; Soft-bone.



From left to right these fishes are: Eel-goby; Blenny; Achilles Surgeon Fish; Wrasse; Cowfish; Wrasse; Surgeon Fish; Moorish Idol; Golden-lined Pentapus; Swellfish; Poison Scorpion Fish; Wrasse; Damsel Fish; Spinetail; Swellfish; Catalufa; Oarfish; Japanese Sea Bass.



From left to right these fishes are: Mackerel; Wrasse; Banded Cirrhitid; Spinetail; Unidentified; Damsel Fish; Crested Scorpion Fish; Parrot Fish; Butterfly Fish; Trigger Fish; Butterfly Fish; Red Frogfish; Wrasse; Red-and-white Squirrel Fish; Black Gulper; Wrasse; Parrot Fish; Wrasse.

Photo, courtesy American Museum of Natural History.

A canoe and totem poles from Alaska.

THE STORY OF ALASKA

PEOPLE of warmer climates sometimes think of Alaska as a raw, rough country, a country of rugged mountains and barren snow-covered plains, a country of short summers and bitter winters, a country with little pleasure and abounding peril. Some novelists have written as though all the men were creatures of the wild, with primitive wants and passions—savage creatures with savage loves and hates, whose lives were a perpetual struggle with cold and hunger. This is not the real Alaska, of which we shall try to tell you something.

Through the first years of Alaska's history no one even guessed the riches that lay buried in the heart of this great white land of the North. The story of Alaska really begins with the days of Peter the Great of Russia. It was a time of great excitement throughout Europe, for Guillaume de Lisele, First Geographer to the King of France, had just given to the world a new map showing a great unexplored country between Asia and America. It was reported that this land was one of fabulous wealth, a veritable Eldorado. France and Spain at once sent ships sailing over the seas to explore and claim the new country for their respective sovereigns.

Wonderful tales of the northwestern land drifted to the ears of Peter, tsar of Russia, and he, too, resolved to add it to his empire. He planned an expedition in charge of Vitus Bering, a Danish navigator in his service. It failed so completely that Bering returned to Russia convinced that "though there was such a country on the maps, there was none in the sea." But the wise Peter and his councilors would not listen to Bering, but sent him out again.

In 1741 Bering sailed once more. For days at a time he was enveloped in an impenetrable fog, and at last he gave up hope and ordered his ship to turn its head homeward. As he did so, behold, the fog lifted! Driftwood and seaweed and birds appeared, and before them lay a great land, and a high peak raised its giant head into the clouds. Because it was St. Elias' day they called the peak Mount St. Elias. Bering himself was wrecked, and no white settlement was made for more than forty years.

THE PURCHASE OF ALASKA BY THE UNITED STATES

The land seemed bleak and bare, with but few natural resources. A few fur-traders wandered over the waste, and Sitka was for a while a considerable town, but furs became scarcer. Finally Russia needed money, and in 1867 sold this great tract of wilderness to the United States for the sum of $7,200,000. This purchase caused a great deal of excitement, and it was the general verdict throughout North America that the Government of the United States had done a very foolish thing. It seemed sheer "wasteful extravagance to pay $7,000,000 for miles of icebergs and polar bears."

For a time the country was occupied by United States soldiers, but there was nothing for them to do, and a naval officer governed the country. He was withdrawn, and for years there was no government at all, except the tribal customs of the Eskimos and Indians, who were thinly scattered over the land. In 1884 Congress gave the president power to appoint a governor, but did not trouble to make laws for the country. The laws of Oregon were declared to be in force so far as they were suitable.

GOLD DRAWS MEN TO THE NEGLECTED TERRITORY

It was known that there was gold in Alaska, but not much attention was paid to the fact, though in 1895 hundreds of men were engaged in mining, and one or two of the mines produced large quantities of the precious metal. In 1896 rich placer deposits were discovered in the Klondike, near the boundary, but on the Canadian side of the line. A placer is a deposit containing gold in the sandy bottom of a river. Scattered free in the soil, the gold has been washed along with the soil into the stream, where it sinks to the bottom and remains. No expensive machinery is required to get it out: a man simply uses a pan to wash the gold out of the soil. This process is known as placer mining.

Thousands rushed to the Klondike and swarmed over on the American side, but not much gold was found until 1899. Then even richer deposits were found around Nome, on the western coast. Many other fields were discovered, and every boat that could float carried eager seekers for gold to the North. Some men were wonderfully successful. As the result of a single week's work a man might get thousands of dollars. Men went mad fighting for claims that showed good prospects, but some found no gold at all. Deep mines were opened, and more and more of the gold comes from them. From 1880 to 1921 Alaska produced $320,000,000 of gold, nearly two-thirds of it from placer mines.

Gold is found in almost every corner of Alaska, but the individual owners are losing their grasp, and the mountains and rivers are being worked by large corporations with ample capital to install expensive machinery. "The day of bucket and windlass has passed for the Klondike. Dredging and hydraulicking have taken their place, and the trains and steamers are loaded with powerful machinery to be operated by vast corporations."

MANY NATURAL RESOURCES BESIDES GOLD ARE PRESENT

Gold is not the only mineral found in Alaska. Copper-mining began in 1901, and since that time other deposits have been found, and now there are several smelters in operation. While not so large as the production in some other regions, the value of the copper produced is large and is increasing. Some day much more may be extracted than at present, as there seems to be an almost unlimited supply of the metal.

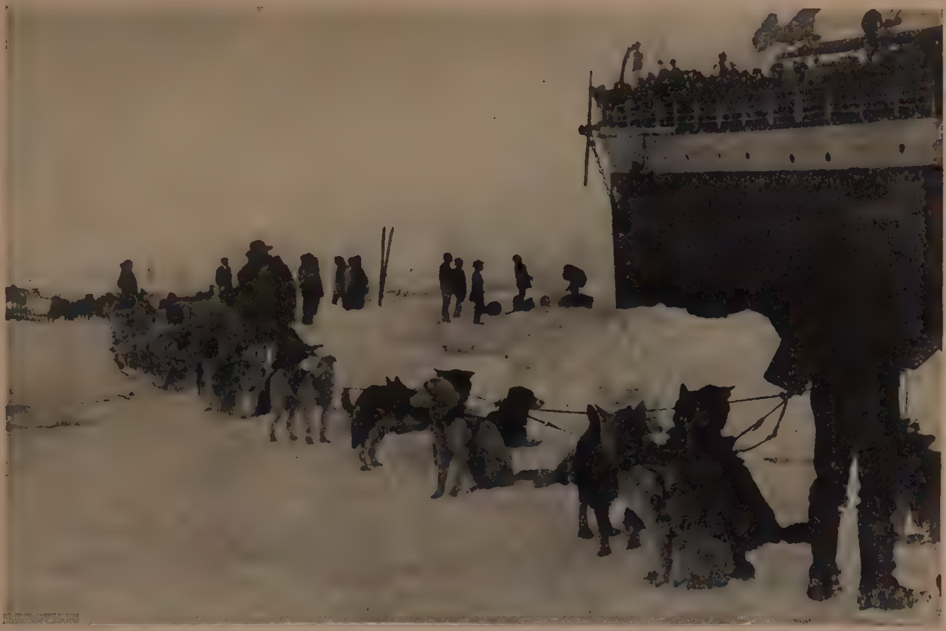
There are vast fields of coal in Alaska, but they have not been worked very much. Some of the coal is good, but much is rather low grade. Coal is so heavy in proportion to its value that the coal-fields will not be worked until more railroads are built so that it can be moved more cheaply.

Tin is found, and there is some petroleum, though how much is not known. Some good marble is found, and some gypsum also. Small quantities of other minerals have been found. The truth is that the country has never been really explored, and we do not yet know how valuable the minerals are. Some men think that some day Alaska will be one of the chief mining districts of the world.

GARDENS AND FORESTS AT THE EDGES OF GLACIERS

Agriculture, too, has been found to be very profitable in the southeastern portion of Alaska. Potatoes, cabbages, turnips, cauliflowers, beets and other

TWO METHODS OF TRAVEL



Nome, the centre of considerable gold-mining, is frozen in during the winter. Our photograph shows dog teams out on the ice to get mail and freight from a mail steamer prevented by ice from approaching the shore. Photo, Ewing Galloway.

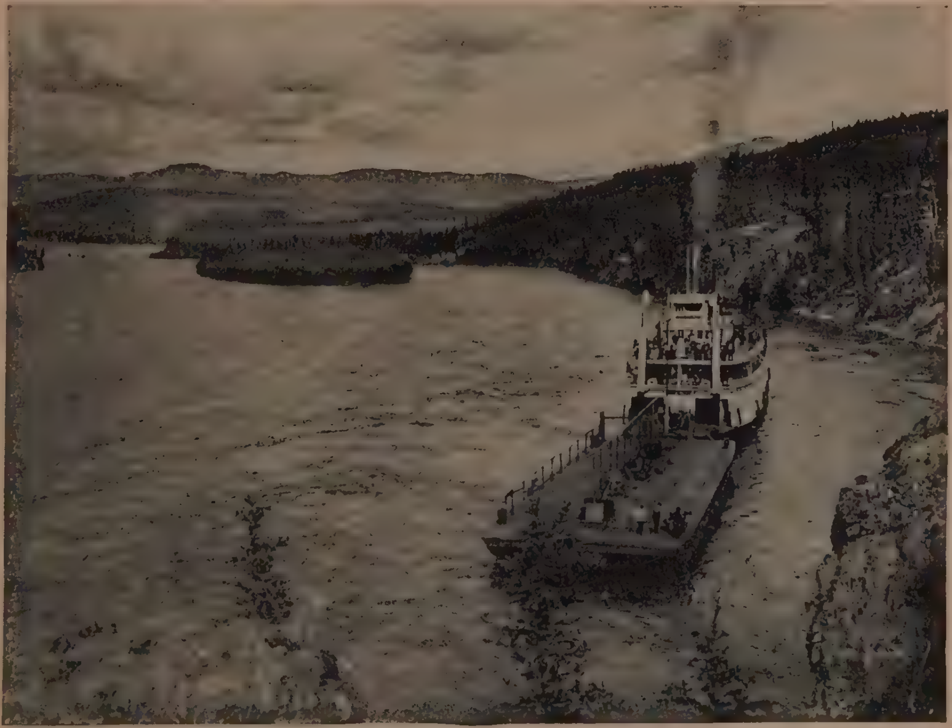


Photo by Burton Holmes, from Ewing Galloway.

In the summer season the cheapest and easiest means of transportation in the North is by boat or barge. Many of the rivers which empty into the Pacific Ocean are navigable for a number of miles inland. Here we see a boat and barge passing through the rapids of a northern river.

vegetables grow to an enormous size in the short Alaskan summer. Like mushrooms, they seem verily to spring up overnight. It is one of the wonderful things of this northland that wild currants, blueberries, raspberries and luscious strawberries can be found growing in sheltered nooks under the very shadows of the glaciers, though some complain that they are too watery.

There are no large farms, for labor is very expensive, and many kinds of food can be brought from the United States more cheaply than they are raised, but the excellent market for fruits and vegetables makes market gardening very profitable. Some of the land produces excellent grass, and cattle and sheep are being raised. As the population increases, the amount of land cultivated will increase also. The United States has established experiment stations to find out what crops can be best grown.

There is much timber in Alaska. Hemlock, spruce and cedar are very common in some parts, and there are also poplar, aspen and birch. In some parts the trees do not grow large, but there are thousands of acres which can be used for paper-making. Some of the plains are treeless, but everywhere the wild flowers are many and beautiful.

FISH AND FURS ARE BOTH IMPORTANT

Many excellent food fish are found in Alaskan waters. The salmon is most important, and there are dozens of canneries which preserve the fish for export to all parts of the world. Several kinds are found in countless numbers, and some of them are smoked and dried instead of being placed in cans. Cod, halibut and herring are also caught. Though the whale is not a fish, we often speak of the whaling industry along with fishing. Men have hunted for whales around Alaska for a long time, but not so many are caught now as in former years.

Once the sea-otter was common, but now it has almost disappeared. Thousands of seals once covered some of the islands, but they were hunted so vigorously that a few years ago they, too, seemed doomed. The United States Government took charge of them, however, and forbade anyone to kill them. They have now increased in numbers, and it will not be long before sealskins will again be plentiful in fur shops.

Sand-otters, beavers, ermines, minks, bears, foxes, lynxes and other fur-bearing animals are found, but the Government allows them to be killed only at certain seasons of the year. Through these rules it is hoped that the animals will increase in numbers and that Alaska will continue to be able to furnish warm furs.

HOW THE REINDEER CAME TO ALASKA

The native inhabitants of Alaska are Eskimos and Indians. Most of them make their living by fishing and hunting. Sometimes game was scarce and they suffered from hunger. They had no domestic animals except dogs, which were used in hunting and to draw their sledges. Some wise men thought that the condition of the natives would be improved if they had a regular source of food, and in 1892 the Government began to bring in reindeer from Siberia. They were sold or loaned to the natives, who were taught to care for them. They have increased in numbers so rapidly that now they are sometimes killed for food. Many of the natives have herds of them and are growing prosperous. Reindeer flesh is good for food, the skins for clothing, and the animals are trained to pull sledges.

RAILWAYS THE GREAT NEED OF THE COUNTRY

At the same time the population is very small. At the census of 1920 there were only about 27,883 white people and 27,153 Indians and Eskimos and others in a territory almost one-fifth as large as the United States. It is plain that such a small population cannot build the railroads needed, but the population cannot grow large until the railroads are built. There are already several hundred miles, most of which has been built to connect mines with the seacoast, so that supplies and ore can be easily carried. The United States Government is building two longer lines which will do much to open the country. Some have dreamed of a road over the Aleutian Islands, which will connect by ferry with Siberia, so that some day we may go from the Atlantic coast to Paris by rail.

The Government is building wagon-roads, sled-roads and trails in every direction. On some of them automobiles run; on others only sledges, drawn by dogs, or in a few cases by reindeer, can go, while only foot-passengers can travel

IN THE FAR NORTHLAND

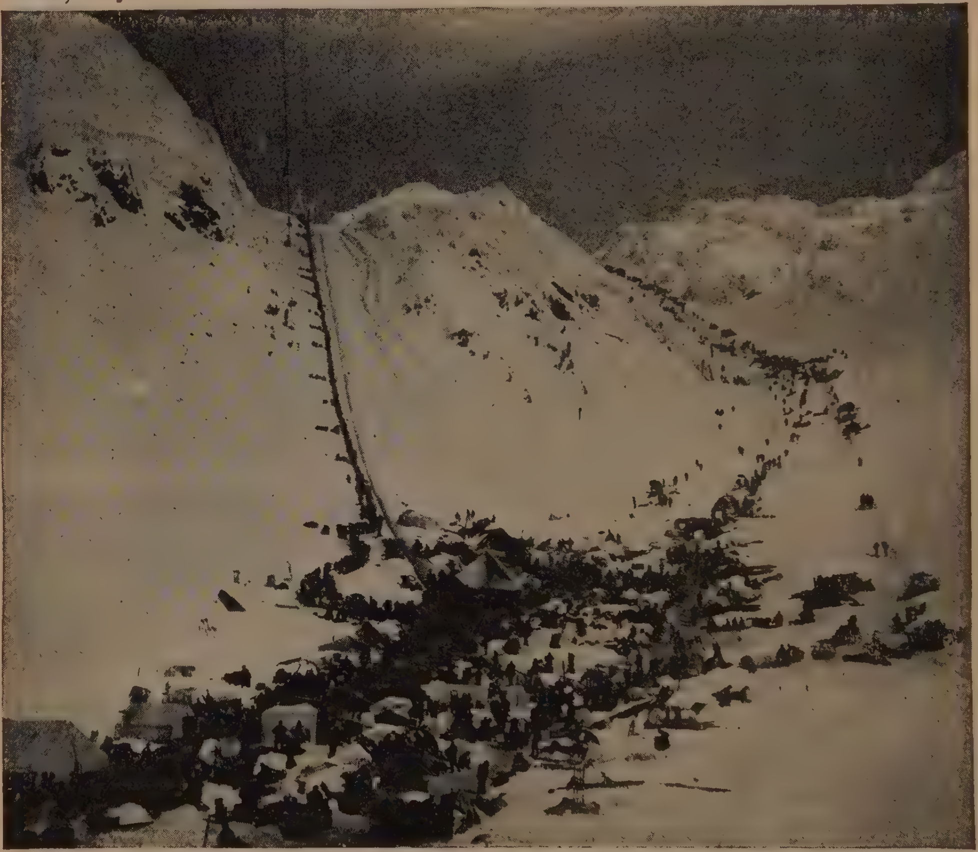
Here is a picture of Sitka, the old capital of Alaska. Years ago it was the seat of the Russian governor, then it was the headquarters of the United States authorities. It is a sleepy, conservative old town, untouched by the bustle and activity that characterize the towns that have sprung up so quickly in the rush for gold. Though founded in 1799, the population in 1920 was only 1,175.

In Alaska the steamers must sail south before the long winter sets in, or the chances are that they will be caught and held fast in the ice-blocked waters of the northern seas. Here we see a tourist steamer making its way through the Takou Inlet to the Takou Glacier. It has been surrounded by floating cakes of ice, and needs all the force of its powerful engines to push its way through the freezing waters.

some of the trails. Men often use the rivers as highways in winter when the ice is thick. In summer, when the ice has gone out, boats go up and down.

THE CRAFTY HUSKIES WHICH DRAW THE SLEDGES

But although the railroads have pushed their way into portions of Alaska, and there are several hundred miles of wagon-roads, they do not reach one-fifth of the field as yet, and sled dogs and a few reindeer are largely used for transportation. A good dog in Alaska is worth at least $50. The thick-furred, long-legged "Labrador huskies" are the most powerful as well as the most valuable. A load of 150 pounds per dog is the usual burden, and seven to nine dogs are attached, each by a separate trace. The Labrador harness is used with them, so the dogs spread out fan-shaped from the sledge and do not interfere with each other. The "malamutes," or native Indian dogs, usually half wolf, are driven and harnessed differently—all in a line and one before the other. The malamute is the king of all thieves. He will pull the leather boots off your feet while you sleep and eat them for a midnight supper, and he delights to eat up his seal-hide harness. He has learned to open a wooden box and will devour canned food, opening any tin can made, with his sharp fangs, quicker than any steel can-opener. Once a day only they are fed on raw fish, and while the malamute prefers to pilfer, the husky will go and fish for himself when off duty. Seventy miles a day is the rule with the Indians and their dog teams, and the white man does almost as much.



During the height of the rush to the gold-fields such a sight as this was not uncommon. As soon as the spring came men made their way over the trails, carrying their packs on their backs. This is a scene in Chilkoot Pass en route to the Yukon in 1898. Photo by Burton Holmes, from Ewing Galloway.

The dog-driver carries a club and seal-hide whip, both of which he uses unmercifully, for the dogs are very fierce and delight in fighting. A fight among these fierce, half-tamed dogs of the North is not like the fights we see among our own. They fight wolf fashion—strike and leap away, strike and leap away—and the fight is to the death. Each dog knows this law and fights with a horrible intentness. Leap and slash, they fight—until lips and heads and bodies are gashed and bleeding. Around the combatants sits a staring circle of huskies. When either dog shows signs of losing his feet they stand up eagerly; and when at last the defeated dog goes down, they close in snarling and yelping, and the dog, screaming with agony, disappears underneath a heaving mass of bodies. There is no mercy shown among the creatures of this wild land. The toil of the traces seems the supreme expression of their being. Men wise in the ways of the wild will tell you that sick dogs have been known to die of a broken heart when cut out of the traces.

Alaska is a wonderful country, and will be visited by more and more tourists as its marvels become better known. It has high mountains, great glaciers, deep forests, beautiful fields, wonderful flowers and interesting animals. Some volcanoes are still alive, among them the noted Mount Katmai, which, with the valley of 10,000 smokes, has been made a national monument. On June 6, 1912, Katmai erupted with such violence that it blew its head off. This was one of the greatest volcanic upheavals known in history. It is thought that among the Alaskan mountains at least twenty other peaks are active.

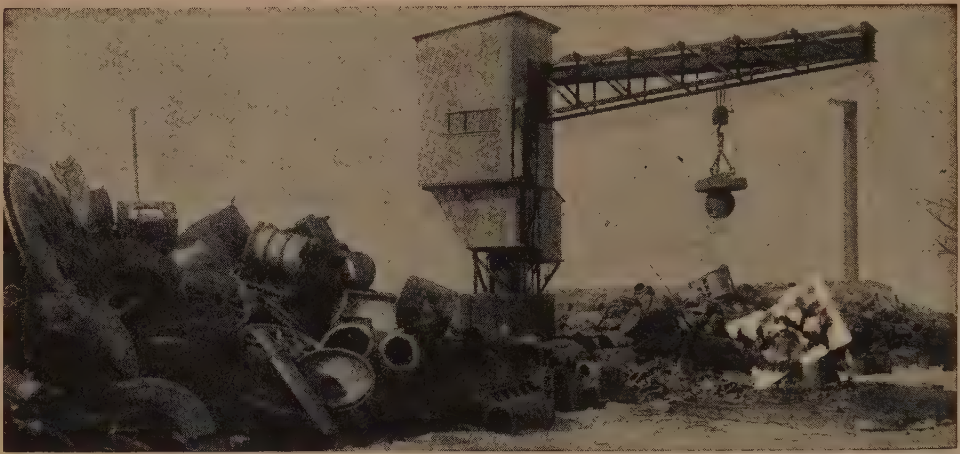
There is a great difference in climate in the interior and on the coast. In the interior a temperature of 60° below zero in winter is not unusual. On the coast the thermometer rarely falls below zero.

In all the vast area of Alaska there are too few people to subdue the land. When the last census was taken there were five white men for every white woman in the territory. Some day, when the railroads are built, the tide will turn toward this great territory so full of riches of many kinds. Many places in Europe which are quite as far north are inhabited by large populations. Norway, Sweden and Finland are in about the same latitude. There is no reason why Alaska cannot support hundreds of thousands of settlers. Perhaps the day is not far when such numbers shall live there.

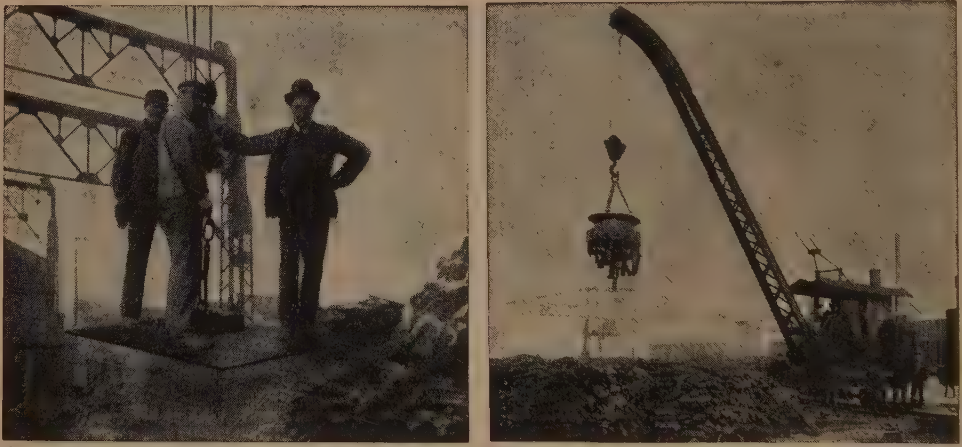
Farther north than Nome, by hundreds of miles, is this settlement at Point Barrow on the Arctic Ocean. This is the northernmost settlement on the continent. This picture was taken during the short summer season.

Photo, Ewing Galloway.

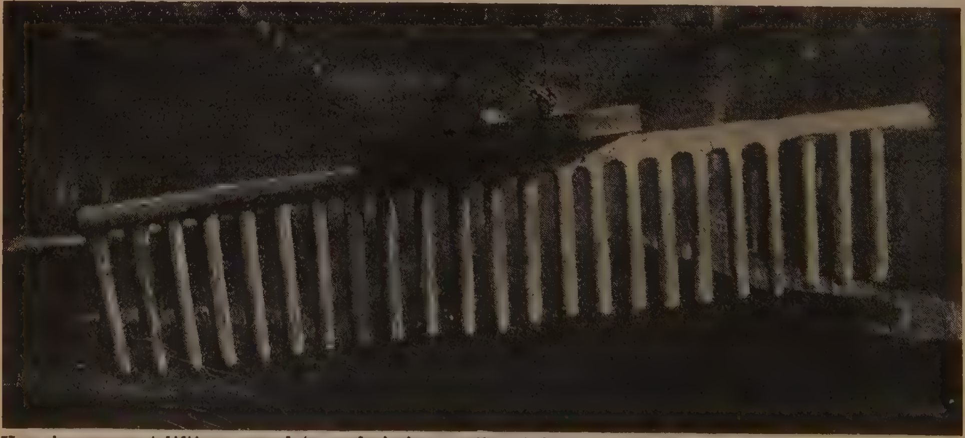
ONE OF THE BIGGEST LIFTING MAGNETS



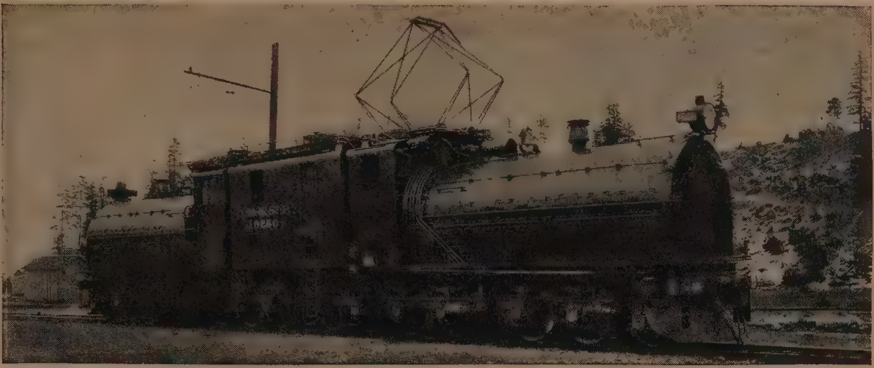
This picture shows how old machinery is smashed up with the help of one of the biggest lifting magnets in the world. A skull-cracker, weighing 22 tons, is raised and then allowed to fall on the old iron.



A comparatively small magnet will lift a ton of steel with three men standing upon it, as seen on the left. On the right, ingots of iron are being moved by means of an electromagnet attached to a traveling crane.



Here is a magnet lifting several tons of pig-iron as though it were a feather. Such a magnet will move a thousand tons of iron in a day. This iron has cooled after being run into channels, as you read in the chapter on Iron and Steel. Magnets are used in shipbuilding for holding steel plates in position till riveted.



Photo, courtesy Chicago, Milwaukee and St. Paul Railway.
A 265-ton high-speed gearless electric passenger locomotive.

WHAT ELECTRICITY CAN DO

MOST of us know something about magnets. The earth itself is one vast magnet. The magnetic force of the earth, passing, age upon age, through certain ores, has magnetized these and made them into natural magnets, which we call the lodestone. All this we know already, and we know also that we ourselves can transfer this magnetic power of the lodestone to iron and steel, and make magnets of these. Steel which has been so treated remains magnetized, so we call it a permanent magnet.

A magnet of this type is a good servant that does much work for nothing. It is a permanent magnet, or magnetized needle, which makes the mariner's compass, to guide sailors about the world of waters.

People of old time knew something of the wonders of the lodestone, the natural magnet, and attributed to it powers more magical than those which writers of stories bestow upon the fairies. Savages generally worship anything which they fear or cannot understand; people in Europe used to do almost as foolish things, and especially was this so in regard to the lodestone. The amusing thing is that we, in these days, have magnets which, while they cannot perform the marvelous feats supposed to be performed of old by the lodestone, do really much more wonderful things than worshipers of the lodestone ever dreamed of. Of course it is the magnet known as the electromagnet of which we are now speaking.

The secret of its immense usefulness is that one moment it is a magnet of enormous strength and the next moment it is simply a piece of unmagnetized iron. The permanent magnet is too faithful; like the lichen on a rock, it must go on clinging to that which it holds. So that, although it will pick up a needle or a cannon-ball, it will not put either down, but will go on holding it until its magnetism grows faint and the weight of its burden becomes at last too heavy. It is like a badly trained dog which will run and pick up a thing, but will not give it up. The electromagnet is a giant which a little child can control and direct.

We have seen how a coil of wire—wound round a pencil, for instance—becomes endowed with magnetic power when an electric current is passed through it. There is a famous law known as Ampère's Rule that tells us which is the north-seeking pole and which the south-seeking pole in such a magnet. The rule says that if you try to imagine yourself swimming with the current along the wire, the north pole will always be on your left.

Thus there is something quite definite in what happens when a current travels along a spiral path, and something equally definite takes place if a bar of iron is placed inside the spiral, or coil. The iron itself becomes a magnet, but of enormously greater power than that of the coil itself.

A simple electromagnet is very easy to make, and with it many interesting experiments can be carried out. If you magnetize a knitting-needle or a bar of steel by stroking it from end to end a few times with an electromagnet, this will convert the steel into a permanent magnet; while the electromagnet itself, the moment you disconnect it from the battery, will lose its magnetism! Here is an interesting example of a temporary power or force creating a lasting one!

The power of an electromagnet can be very great. It is actually largest in proportion to the weight of the magnet when the magnet is very small. An electromagnet weighing only a few grains has been made to lift 2,500 times its own weight. The great lifting magnets used in factories are made as large as five feet in diameter, and may weigh three or four tons. Their lifting power is only four or five times their weight, so that a four-ton magnet could not pick up more than about twenty tons. Such magnets are much used for loading and unloading pig-iron, steel ingots, girders, iron plates, and scrap, as seen in the pictures on pages 5796 and 5799.

These huge magnets of industry are known as the ironclad type, and are usually circular. The magnet is raised or lowered by a block and tackle or by a crane; it is dropped down on a steel ingot, the current is switched on, and the magnet is raised. The ingot clings to it by magnetic attraction just as long as the current flows through the coil. The magnet, with its load, is then gently slung over to a truck and lowered, and the current is cut off. The magnetic force vanishes, and the ingot has been gently transferred to its new position.

So tenaciously does a magnet hold its object that recently magnetic devices have been made to grip and hold pieces of crude metal which are being shaped by machinery. High-speed portable hammering machines are made, and other magnetic machines for chiseling and riveting. These are important labor-saving devices which work with great rapidity. There are a hundred other uses to which this power, so easily operated and controlled, is put in modern factories.

HOW THE MAGNET HELPS THE WORK OF THE DOCTOR

Magnets have a special use in extracting splinters or bits of steel or iron from the body, and particularly from the eye. The attractive power of the magnet will draw to itself pieces of metal so small that their removal in any other way would be almost impossible.

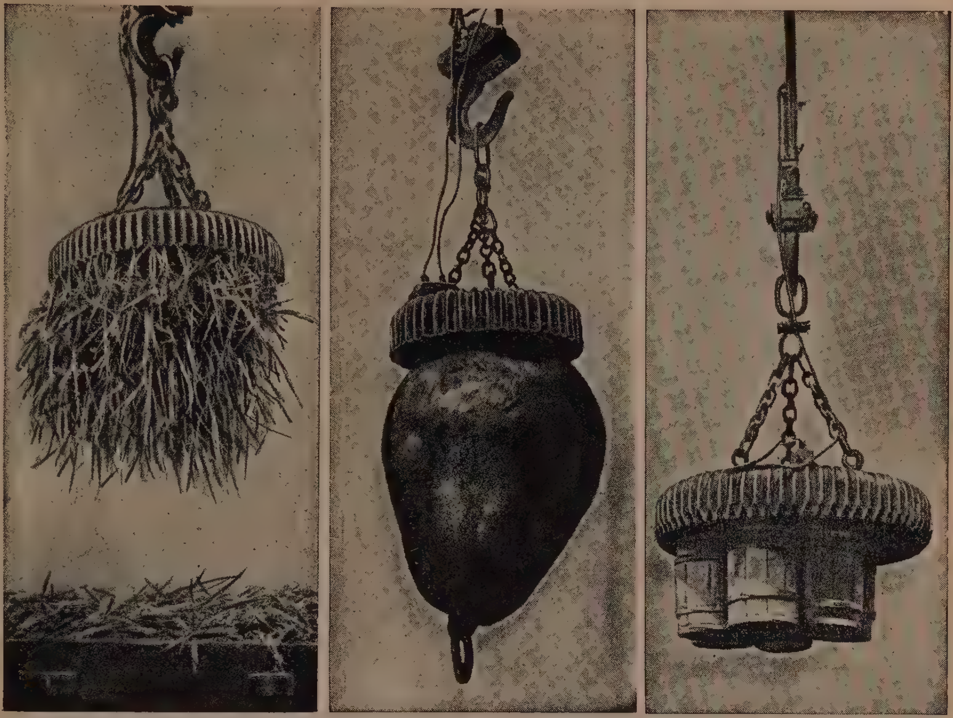
One great advantage the electromagnet possesses is its instantaneous response to an electric current. When the current is switched on, the magnetism is produced at once, and in a well-constructed magnet its power ceases the instant the current is cut off. There is, however, such a thing as *residual magnetism*—a lagging-behind of the power—and this effect is overcome by using a number of soft iron wires or thin iron strips, each one insulated from the others and built up together, instead of using one solid piece of soft iron. With a magnet made in this way the magnetic power shows no signs of lagging behind, even for the thousandth part of a second, after the current has been cut off. As a result magnetic instruments and machinery can be worked at marvelously high speeds.

WHAT HAPPENS WHEN WE PRESS THE BUTTON OF AN ELECTRIC BELL

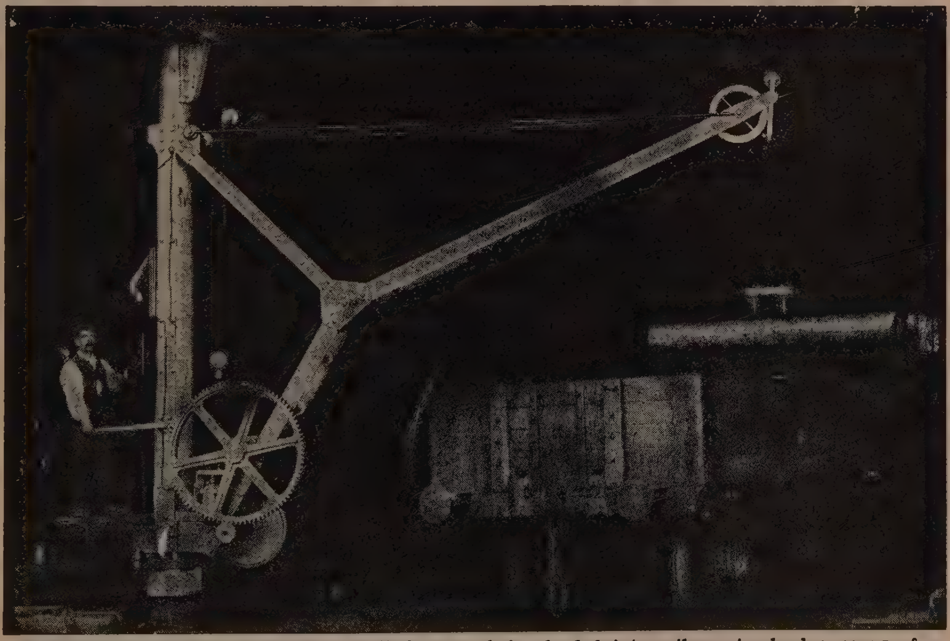
Perhaps the best-known device depending on an electromagnet is the ordinary electric bell. So accustomed are we to ring a bell by pressing a button that not one person in a thousand would ever bother his head to think how it is done.

Every electric bell, and every electric indicator, depends on an electromagnet; the magnet provides the power which moves the hammer which strikes the gong. If you follow the wires from the button, you will find that they lead to the electric bell and a battery. The bell-push button is nothing more than a simple switch, or contact-maker. On pressing the button a piece of spring metal is pressed against another piece of metal, so that a complete circuit is established, and the current from the battery is then enabled to flow through the coils of a small horseshoe electromagnet. Fixed to a small

HOW THE GIANT MAGNETS ARE USED



Here are some of the ways in which the electromagnets, the most powerful of which will lift more than 20 tons, are used. In the left-hand picture a great mass of scrap steel is being raised; in the right-hand picture six barrels of nails are held by the magnet. In the centre the magnet is holding a huge mass of steel weighing over 22 tons, called a "skull-cracker," which is used to smash up old iron.



In this picture some very heavy iron cylinders are being loaded into railway trucks by means of an electromagnet attached to a crane. As soon as the cylinder is hanging above the truck, the current is shut off, the magnetism ceases, and consequently the iron falls. These magnets are very cheap, considering the work they do. They are particularly useful in handling pig-iron, scrap and steel products.

brass pillar is a piece of spring metal to which is fitted a small iron plate, which faces the poles of the magnet; in another pillar is a metal screw which just touches the back of this spring *armature*. The wires are joined up as shown on page 5801, and by following the arrows it can be seen that the current travels from the carbon rod in the battery to the coils of the magnet, then to the armature, to the contact pillar and to the push-button and through the push-button back to the zinc rod of the battery.

As soon as the magnet is energized it attracts the armature to it, and this motion makes the hammer strike the gong. But we can see that in doing so the armature will be drawn away from the contact-pin, and this means that the current is broken.

When this happens the magnetism disappears; consequently there is nothing now to draw the armature, which springs back. It then again completes the circuit, and the magnet again pulls the armature toward it; so that again the circuit is broken. The same thing, in fact, happens over and over again, with the result that we have a rapid succession of taps on the gong, and this continues just as long as the button is pressed.

THE ELECTRIC MASTER-CLOCK THAT KEEPS ALL THE OTHERS IN ORDER

Something akin to the bell is the electric clock, which is made to work by signals from a master-clock. Several types exist. One type of master-clock is made to give a signal—really to make a contact effective—once or twice each minute. An electric current is then caused to flow through the coils of a small magnet fitted in each electric clock which it controls. The power of this magnet is used to work a little ratchet wheel, and to jerk it forward one tooth at a time. The wheel is geared in such a way that it actuates the hands of the clock, and at each contact it moves the hands through a space on the dial equal to half a minute, or a minute, as the case may be. While the master-clock is thus an ordinary timepiece, the hands of the electric clocks that it controls merely move forward in jerks at fixed intervals; anyone can see this by watching an electric clock for a minute or two. One master-clock can control any number of electric clocks, which all keep exact time with it. Another type is shown on page 5803. An important feature of the electromagnet is that it is just as successful in dealing with tiny currents as with powerful ones. An interesting instrument is that for measuring the working of the human heart. It is known to-day that all muscular movements of the body are accompanied by certain electrical changes, and if a very sensitive galvanometer is connected to a muscle, a feeble current of electricity will pass from the *passive* part of the muscle to the *active* part of it, through the galvanometer, causing it to register every movement.

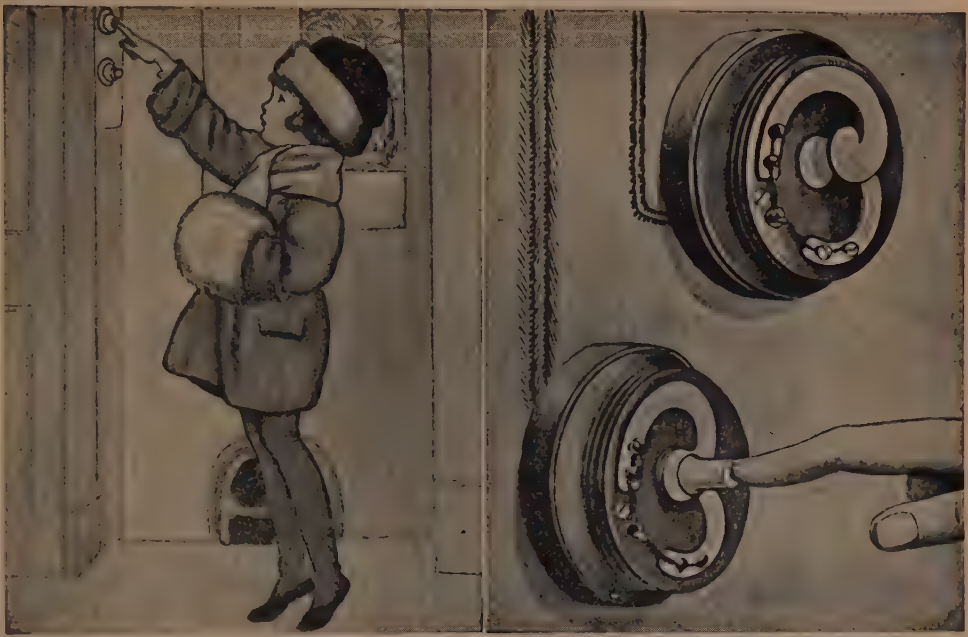
A marvelously sensitive measuring instrument is used to make measurements of the muscular contractions of the heart, of which it makes, with the help of photography, an actual chart somewhat resembling that of a recording barometer. Between the poles of a very powerful electromagnet is stretched a delicate shaving of quartz, about a thousandth of an inch thick, yet sufficient to bar the way to a tiny beam of light. The quartz is coated with a thin film of silver to make it a conductor. The feeble current caused by the heart-beats passes through the quartz, which, as we have seen, makes it behave like a magnet. It is, of course, infinitely feeble; but the power of the electromagnet is so great that it repels the quartz which moves to one side—only about a thousandth of an inch or so—and allows the beam of light to reach a moving band of photographic film. The heart-beats are thus recorded by photography, and the character of the record reveals the condition of the patient.

THE WONDERS OF THE MAGNET IN PHOTOGRAPHING HEART-BEATS

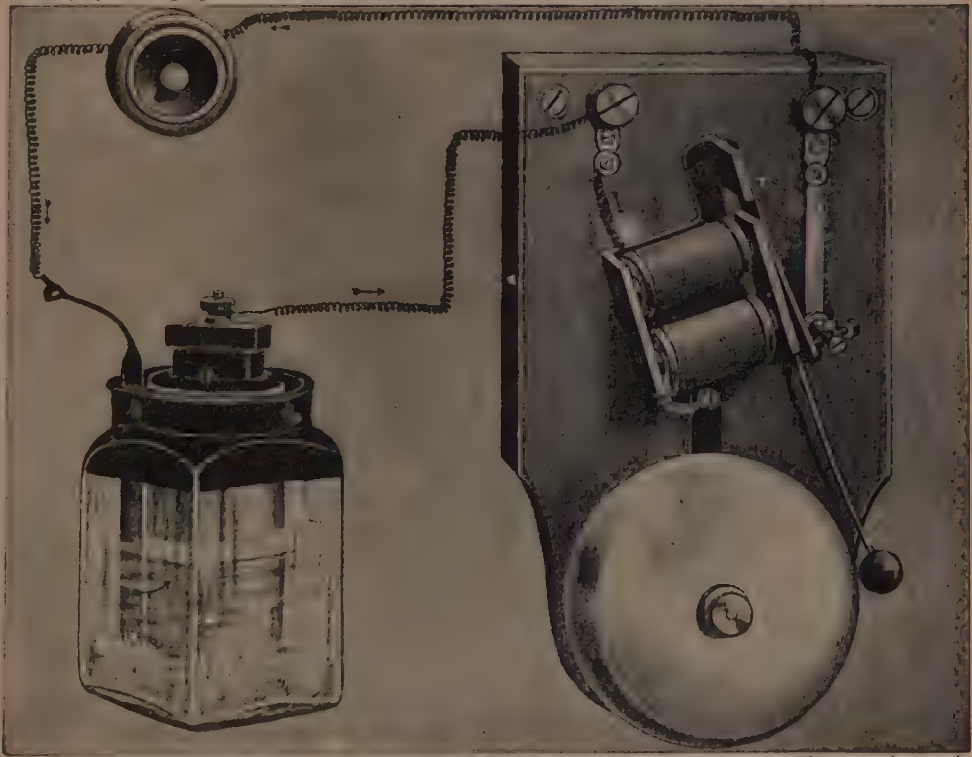
Not only are heart-beats recorded in this way, but the loudness of the sounds of the heart, and even their tone and pitch, can be photographed by a microphone device in which delicate currents are set up so as to affect the galvanometer. Such records represent the most refined and up-to-date applications of the electromagnet, and are of the utmost value in medical science.

All kinds of delicate instruments for measuring very small currents are based on the action of a magnet, which repels or deflects a fine wire or wire coil when a feeble current passes through it. Sometimes a little coil is suspended between the poles of a permanent horseshoe magnet, and a tiny mirror is fixed to some part of the coil in such a way as to reflect a spot

WHAT MAKES THE ELECTRIC BELL RING



These pictures show us what happens when we ring an electric bell such as we find at the front doors of most houses in these days. The pressing of the button, as seen here, brings two pieces of metal in contact and so, by setting up a circuit, allows the current to flow through the wires in the right-hand picture.



The current is generated in the cell on the left, which may be anywhere in the house. When the button is pressed the current flows from the cell, magnetizes the two-coil magnet on the board, and so draws toward it the strip of soft iron carrying the hammer, which thus strikes the bell. All the time the button is pressed the iron, which has a spring over it touching the pointed screw on the right, moves to and fro.

of light on to a scale. The smallest movement of the coil is then shown, greatly magnified, by the moving of the spot of light along the scale. Such an instrument is called a mirror galvanometer.

The electromagnet may be looked upon as serving two great purposes. One is to provide power; the other to provide a means of measuring excessively feeble electric currents.

HOW SPARKS ARE MADE TO FLY THROUGH THE AIR

In November, 1831, Faraday showed that it was possible to call forth currents by means of a magnet. A magnet plunged into a coil of wire will cause a current to flow along the wire. If two coils are placed side by side, whenever a current is sent through one of them an *induced* current will be set up in the other. If both coils are wound over a bar of soft iron, the induced current is enormously powerful. This power of induction is made use of on the widest possible scale. A typical example is what we call the Ruhmkorff coil, for many years used almost entirely in wireless telegraphy and still used in most X-ray sets. Little Ruhmkorff, or *induction,* coils are inexpensive, and many fascinating experiments can be performed with them.

A central magnetic "core" is made up of pieces of soft iron wire, and two layers of thick copper wire are wound round it; this may be looked upon as a simple electromagnet. Over the thick coil, called the *primary,* is wound a coil of very fine wire, often running into many miles; this is called the *secondary.* An electric current is passed through the primary, and interrupted several times a second by means of an arrangement very similar to that we have already seen in the electric bell, and at every interruption an induced current is set up in the outer secondary coil, of such high voltage that, if two wires leading from the ends are brought near together, intense sparks will fly across the gap, the current breaking down the resistance of the air between them.

THE BEAUTIFUL EFFECTS POSSIBLE FROM AN ELECTRIC CURRENT

The voltage of the secondary current depends on how many times the number of turns of wire in the secondary exceeds the number of turns in the primary. Thus, if twenty turns were wound round the magnetic core of soft iron, and twenty thousand turns round this in the form of the secondary coil, whatever *volts* were passed through the primary would be magnified a thousand times in the secondary. A boy with a four-volt battery could produce a current of four thousand volts with quite a small and cheap coil.

Large coils are used to-day for producing X-rays which give a quarter of a million volts, making a terrific spark that will jump across twenty inches of air. The spark from a small toy coil is of such intense heat that if a piece of thin paper be held between the wires carrying the sparks it will be perforated by numbers of tiny holes, which are burned through it. Beautiful effects can be obtained by passing the current from a coil through a glass tube filled with such a gas as nitrogen or helium in a rarefied condition.

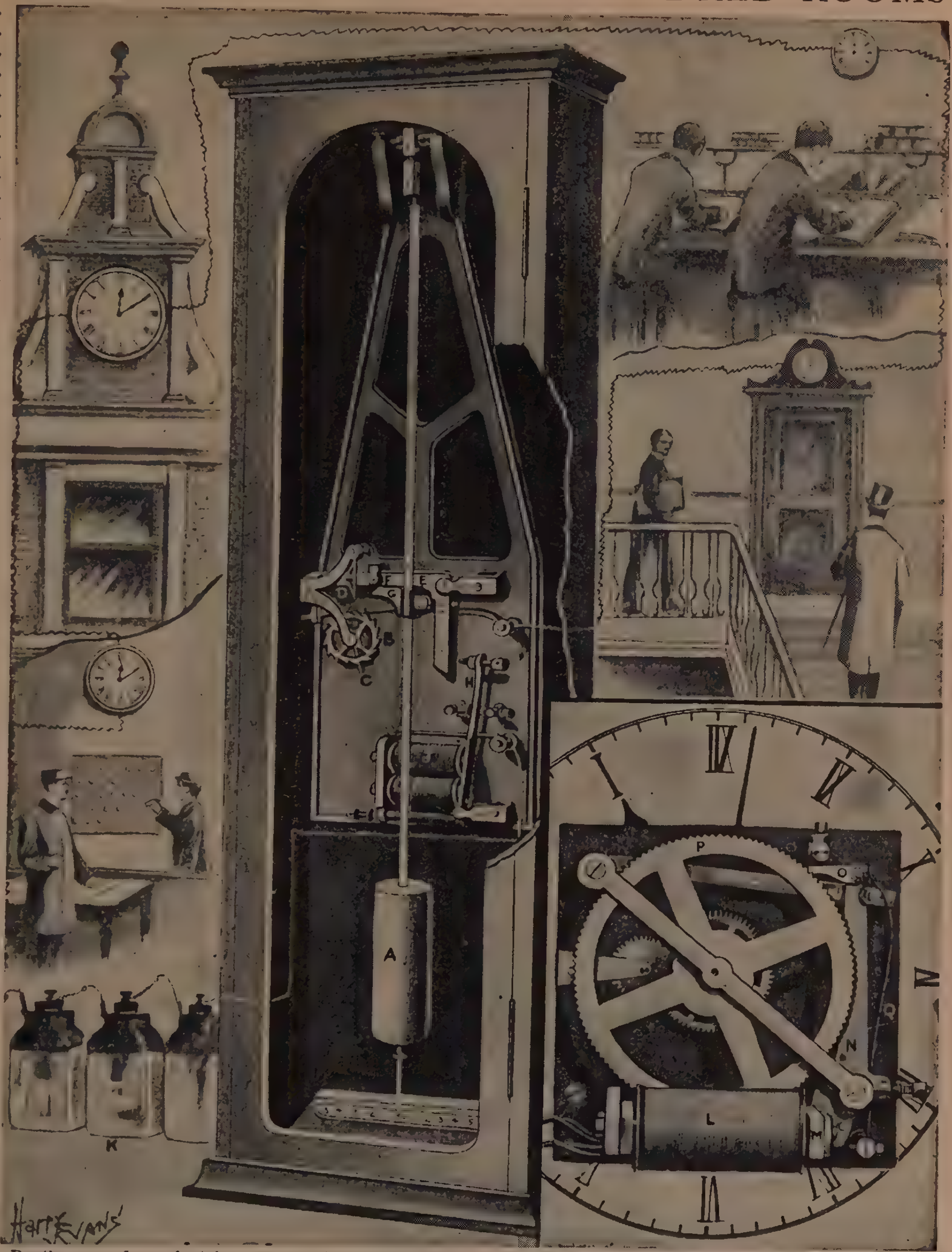
The electromagnet gives us power when and where we want it by the pressure of a button or the touch of a switch, and exerts its power at the right instant.

Power, light and heat are probably the most familiar everyday evidences of the place that electricity takes in our life. The telegraph and the telephone play parts just as intimate, though in turning to them we leave the big forces of electricity and deal with currents of infinitely small magnitude. We shall read more fully on pages 6183 and 6049 the stories of telephone and telegraph.

Another thing of vast use to us which electricity accomplishes is the covering of metals with beautiful, fine deposits of silver, gold, nickel, and so on. The process of electroplating is one of the most widely used in the world. It has a very real importance, for it enables us to coat metals which are easily affected by the air with a cheap covering that protects them. Iron easily rusts in the air, and in the course of time it practically crumbles away. But if a piece of iron is well cleaned, connected by a wire to the negative pole of a battery and placed in a bath of water containing a salt of nickel, and the positive pole of the battery is joined to a piece of nickel also immersed in the liquid, ions of nickel will travel along through the liquid in an endless procession and deposit themselves upon the piece of iron in the form of an infinitely thin layer of nickel metal, which, as we know, can be beautifully polished and will not allow the iron to rust.

In similar ways the jeweler can plate objects with gold; the silversmith can

TELLING THE TIME IN A HUNDRED ROOMS



By the use of an electric current a hundred clocks in a hundred rooms can be so controlled, or synchronized, by a single pendulum, that all show exactly the same time. The diagram shows the synchronome system. The master-clock consists only of a pendulum (A) which pulls round the wheel (B) once every half minute, causing the vane (C) to withdraw the catch (D) and allow the gravity lever (E) to fall. The roller (F) runs down the bracket (G) fixed on the pendulum-rod, pushes the pendulum aside, and forces the upright arm of the gravity lever to touch the point of the screw in the end of the armature (H). Thus the circuit of the coil electromagnet (J) is closed, and the current from the battery of cells (K) flows through the dials all over the building. The clock faces have no pendulums behind them; they are known as impulse dials, and consist, as shown in the right-hand corner, of a large wheel actuated by a magnet to work other wheels. The pointers on these dials advance half a minute while the magnet (J) attracts the armature (H) and throws the lever (E) up on its catch again. The magnet (L) behind the dial receives the impulses which attract the armature (M), moving the lever (N) so that the click (O) picks up another tooth of the wheel (P). In this way the spring (Q) propels the wheel, and the minute-hand attached to it, one half minute. Thus every dial is affected by the master-clock.

make table silver of some cheap white metal afterward plated with silver, called electroplate, and so on.

THE MAKING OF NITRIC ACID FROM THE NITROGEN OF THE AIR

Electricity is used in hundreds of industries, and is employed in a myriad ways by the engineer and chemist. Nowadays immense quantities of oxygen gas are actually manufactured by electricity, for use in such processes as welding with the oxygen and acetylene flame.

This power of the current to undo the bonds of nature and resolve substances into their elements is of great value, for when electricity gives us a metal out of some metallic compound it gives it to us in a marvelously pure state. Copper, for instance, of extraordinary purity is made in this way, and is spoken of in commerce as electrolytic copper.

A chemical industry that is daily becoming of greater importance to the world is the *obtaining of nitrogen from the air*. The nitrogen occurring in such vast quantities in the atmosphere is a thing vital to the growth of plants and crops. Artificial fertilizers must contain nitrogen, and enormous quantities of nitrogen compounds—such as sulphate of ammonia, nitrate of ammonia, and so on—have to be used by farmers, especially in the less temperate countries.

TEN THOUSAND TONS OF FERTILIZER MADE BY AN "ELECTRIC SUN"

Priestley, the English chemist who discovered oxygen, noticed in 1779 that an acid was produced when an electric spark passed through the air. A few years later Cavendish proved that it was nitric acid, an acid composed of nitrogen, hydrogen and oxygen. Nitrogen had first been obtained, in the form of nitric acid, from the air! To-day huge water-power electric plants are in use for extracting this valuable gas from the atmosphere.

A well-known method invented by Birkeland and Eyde consists of passing air over a brilliant sheet of intensely hot flame which is called an electric sun. This flame, a huge electric arc-light in reality, is spread out by the help of magnetic force to a length of about six feet. It plays upon the air in a brick-lined furnace, and the nitrogen is passed into milk of lime, with which it helps to form the fertilizer.

In 1905, when this method was invented, 115 tons of fertilizer were made from atmospheric nitrogen. By 1919 the quantity had increased to ten thousand tons. To-day fixation of the nitrogen of the air, both in the form of nitrogen with which to feed the crops and to obtain oxygen for commercial purposes, is a great industry, another source of world wealth that has resulted from electrical discoveries from time to time.

We could go on giving one example after another of the extraordinary general use which is to-day made of this power.

Everybody now rides in electric cars or electric trains. Probably in another generation the steam engine may be something of a curiosity, for all countries will follow the lead of France, where it has been decided to electrify the whole railway system.

HOW THE TROLLEY PICKS UP THE POWER WHICH DRIVES IT

The first great user of electric power for traffic was the street railway. In the days of the horse car a third horse was often used to help the usual pair of animals when a hill was reached. The electric car has all the power it wants to climb any hill; the driver has only to move a lever or turn a handle and power flows into the motors and makes the steepest grade a plaything. Frank J. Sprague, an American engineer, was the pioneer in electric-railway work on a large scale. He contracted with the Union Passenger Railway Company of Richmond, Virginia, to equip its thirteen-mile system of street railways. Cars ran in 1887. This was the first complete system, though experimental lines had been constructed before.

Usually an electric car obtains its current from an overhead wire. This wire is supported from poles placed at intervals along the line, and is carefully insulated. The rails or lines themselves act as the other conductor, and the overhead wire and ground rails act like the two wires leading from an electric battery. Sometimes we see an electric car with no battery or overhead wire, but if we looked between the rails we should see a slot running along the ground between them. Beneath the ground are two flat conductors carrying the current, and where such an underground conduit is used the car has a projecting shoe, or plow, which passes through the slot and picks up its current from these two conductors. The conduit system does not use the rails as the return wire for the current.

THE THOUGHT AND EXPENSE THAT HAVE BEEN PUT INTO ELECTRIC CAR LINES

An enormous amount of thought and expense has been put into the electric car, which has now become a marvel of engineering skill. The motors, which are fixed underneath the body of the car, must be dust-proof and water-proof, almost entirely inclosed in an outer armor of iron. Tremendous power is necessary to start a heavy car, to get the dead weight quickly on the move, and the power of the motors has, therefore, to be far in excess of the actual power wanted when the car is once under way. The motors are often kept cool by special ventilating fans. They must be carefully suspended so as to be kept free from severe shock and vibration.

The driver of a car probably knows as little of the wonderful forces he is controlling as the driver of a train. The controlling devices in an electric car are often very complicated. Sometimes they are largely automatic, so that the driver cannot abuse the great power at his command. As the speed of the car increases, less and less power is required to maintain the running of it. The greatest demand on the power is always at starting and on going uphill. The power of the electromagnet, which enables a car running downhill to cling to the rails, as it were, is a great source of safety, and this abundance of power has made it possible for tracks to be laid on hills which would have been quite impossible to horse-drawn vehicles.

THE REVOLUTION ELECTRICITY HAS MADE ON OUR UNDERGROUND RAILWAYS

So great was the success of electric railways that engineers soon thought of replacing the steam engine as they had replaced the horse. Those of us who are old enough to look back to the first few years of this century, know well what the electric train has done for both elevated and underground traffic in big cities. The small steam locomotives hauling trains were usual sights on the elevated railways of New York City. The underground railway of London, when run by steam engines, is a memory of sulphurous tunnels, smoke and steam, grime and filth. To-day like other subways, it is clean, bright and healthy; even the atmosphere is made pure and fresh by charging the air with ozone.

The weight of a train is, of course, much greater than that of a car, and the electric engine may be a giant. For city and suburban traffic the control mechanism of the motors usually is fitted into one end of a special coach, the rest of the coach being used for passengers; but for longer distances and heavier trains special electric locomotives have been designed, and numbers of these are now in use.

A feature of most electric trains is that there is only one driver, there is no furnace to attend to as in a steam engine, so that no stoker, or fireman, is needed. To many people this appears risky, as something might happen to the driver; but there need be no fear, for with the so-called "dead-man's handle" the engine is so arranged that, if, for any reason, the driver removes his hand from the button at the top, the handle springs back to the "off" position, the current is cut off, and the train stops automatically.

Overhead wires are used on some electric railways to supply the current, but almost as familiar a method in this country is to use a special conductor rail to one side of the track proper. Such an electric track has thus three rails, two for the wheels, and one for the conductor of the electric current. The voltage of the current supplied to the electric motors is high, and it is extremely dangerous to touch the "live," or third, rail—usually fatal. But so quickly does man get accustomed to avoiding danger that, in spite of the miles of electric track that now exist, and of the numbers of men obliged to work on them, accidents are very rare.

THE ENORMOUS PRESSURE OF CURRENT NEEDED FOR LONG-DISTANCE RAILWAYS

The use of electricity on long-distance railways is beset with certain difficulties. The current supplied from the power station must be of a very high voltage, as low-voltage currents require very thick and costly copper cables in order not to offer too much resistance. The current would be supplied at a pressure of many thousands of volts to overcome this difficulty, and would be broken down, or reduced to a lower voltage suitable for driving a motor, by means of transformers installed at substations at various points along the line. The alternating current generated for most electric railways is 11,000 volts; this is turned into direct current of about 500 volts at the substations.

In the case of a very long distance the

line is split up into sections, each section of a certain length being supplied from a separate power station.

THE MARVEL AND AMAZING SIMPLICITY OF THE AUTOMATIC SIGNAL

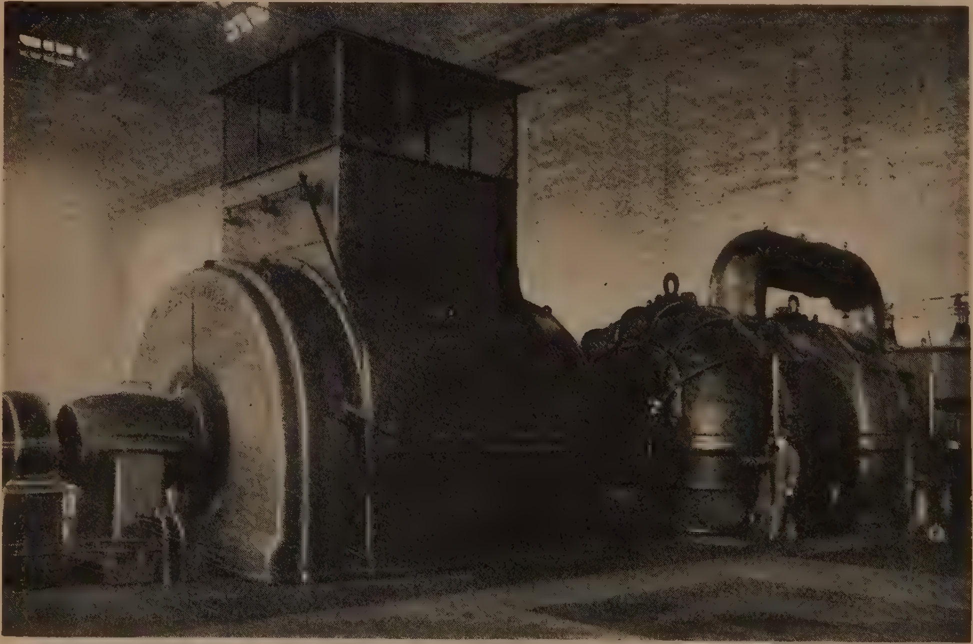
Following the electrifying of railways came improvements in the automatic signals by which a train can show to the train following it whether the line is clear or not. The automatic signal, on which the safe working of the electric and also steam railways so largely depends, is delightfully simple. We have seen how a feeble electric current flowing through a relay can cause the relay to switch on another instrument—in this case the signal light or the signaling apparatus. The current is made to pass through the railway lines to the relay, but it cannot flow to the relay except when the two rails are connected by a conductor.

As soon as a train passes over the rails, however, the current flows from one rail to the other through the metal wheels and axle, the circuit is completed, and the relay operates the signal. In this way an oncoming train knows by the signal whether there is a train in front of it or not. An ingenious arrangement of the circuit causes a red signal light to appear when the line is blocked, and a green light to appear when the line is clear.

A startling development proposed for electric railways is a freight line worked quite automatically, without any driver on the engines. Such a system has been proposed for the Port of New York operating in tunnels, and is used in Chicago. As long ago as 1912 such a railway was actually tried in England. The driverless train was run at a speed of thirty miles an hour along a track laid down at Chelmsford. By means of ingenious mechanical devices the train was slowed up when it came to a sharp curve in the line, and it pulled up at the station as neatly as if controlled by a human driver. The starting and stopping of the trains was effected by a number of levers working in a box at one end of the line. Here one man could control the movement of the various miniature trains with their four horse-power motors, and the movements of the trains were shown automatically on a board in front of the operator.

No one can foresee the outcome of the marvelous work that is now being done in the electrical laboratories of the world. We are only on the fringe of a new world, one among a multitude of worlds of infinite wonder fashioned by the Hand of God. Recent discoveries have been wonderful; those of the next half-century are likely to be even more awe-inspiring.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 5937.



A MASSIVE TURBINE GENERATOR OF 40,000 KILOWATTS IN A NEW YORK POWER HOUSE

LIGHT AND WHAT MAKES IT

THOUGH light has been studied for many ages, it is only within the last century or so that men probably learned enough to make them believe that it consisted of waves of energy; and we must learn that, though the wave theory of light is still generally believed to be true, there is another theory which supposes that light consists of a number of tiny specks of something flying through space.

We know for certain that light moves, and yet this is a thing which we may naturally forget. Let us suppose we are out in the open air on a bright day, or that we are in a room lighted by a steady light; or take the present moment and place as we are reading this page. It seems to us that there is something we call light illuminating this page, which simply stays where it is. But this is not at all what really happens.

All light everywhere is in movement, the most rapid movement in the universe. The light is pouring down from the sky, in at the window, or from the lamp, and up from the page to our eyes, as certainly as if it consisted of raindrops, but with vastly greater speed.

The first fact to learn is that there is something moving which makes light. This movement has been studied in various ways, and the rate of it has been found out. It is the same as the rate at which radiant heat and electric waves move, for light is a kind of electric wave. This rate is about 186,000 miles in every second, or a million miles in less than six seconds. So far as we have discovered, this rate never changes.

Now, there are many kinds of movement, as we know, and this movement of light might be a movement of something that traveled from place to place, or it might be a wave movement which we could compare to the waves of water. When we throw a stone in a pond the ripples run along the surface of the water, but it is not, of course, the surface of the water itself that runs.

The greatest of all students of light since time began was Sir Isaac Newton, and it is an interesting fact in the history of knowledge that Newton did not believe in the wave theory of light. He believed that light consists, not of waves, but of tiny particles of something or other shooting through the air. In the study of such matters as these there never was a mind quite so great as Newton's, and it is interesting to know that, though his idea of light was superseded by the wave theory, in recent years we are coming back to something that is not unlike part of Newton's theory.

The reason why the wave theory still holds its ground is briefly this. If two sets of waves are going in the same direction, and if the crests of these waves come together, the combined crest will grow bigger. If the crest of one wave comes in the same place as the trough of the other, the crest will fill up the trough and the wave will be smoothed out and will disappear. This will be true if the waves are waves of light. It is possible to arrange two beams of light so as to make their waves impinge on one another in this way. When this is done we get a network pattern of light and darkness; light when the waves combine with one another; darkness when they cancel one another. We cannot think of any way in which, if light consisted of clouds or streams of particles, this "interference pattern" of light and darkness should result. The wave motion at present must be called upon to explain it, and, if once wave motion is admitted, then our minds have to imagine something that is waving, or being waved, and it is found convenient, even if it cannot be proved to be a fact, to call that something the Ether.

THE MODERN THEORY OF LIGHT IS NOT UNLIKE ISAAC NEWTON'S

Nevertheless, the twentieth-century school of physicists, who are working at the structure of the atom and its electrical constitution, find very much to recommend some sort of theory of bits of light, or parcels of light, which are very, very small. This is not so very unlike Newton's first rough idea of streams of corpuscles of light, or, as he would have called them if he had been born two centuries later, atoms of light. They are not exactly atoms of light in the view of those physicists we have spoken of, but they behave something like bundles of atoms of electricity.

These ideas have been coupled with the names of Professor Einstein and Professor Planck, who decided to disregard the ether; but they get a great deal of support from nearly all those who have been trying to make models of the atom which would account for all the curious facts observed in the rays shot out from radium, or in the behavior of X-rays when these are turned on to the atoms of other substances; or, again, in the appearance of the light coming from an incandescent gas when it is spread out to reveal itself in a rainbow band, or spectrum. The workers in this field include Sir J. J. Thomson, who, though he does not abandon the ether, finds it hard to reconcile with what he believes to happen when an atom of a gas, or of any other incandescent element, is excited to a point at which it gives out light.

THE MOVEMENT IN AN ATOM AND THE MOVEMENT IN A SOLAR SYSTEM

Most of us are now familiar with the idea of the atom of matter as a solar system in which bits of electricity revolve at high speed round a nucleus, or sun.

There are several particulars in which the revolutions of these electrons differ from those of planets. The first is in their speed. When an electron is making its most jog-trot journey it goes on an average of 1,400 miles a second, and as its orbit is very tiny, it travels round its sun billions of times in a second. Secondly, in a solar system movement goes on continuously and equably, while in the atom there seem to be sudden jumps from one kind of motion to another; the electrons sometimes slowing down and then taking a sudden leap forward, moving, as one writer puts it, like fleas which crawl for a time and then hop.

The third difference is that planets seem to be firmly attached to their sun by what we call the force of gravitation; but in the atom it is electricity which makes the electrons go round, and, as the electrons are all bits of negative electricity, they do not attract, but repel one another. Moreover, electrons may fly off to attach themselves to another system.

THE MOVEMENT OF THE ELECTRONS AND HOW IT MAKES LIGHT

But it is certain that the electrons start to go round the nucleus in circles, and that they must be pushed out of these paths by the repulsions of their neighbors. Consequently the first idea people had about them, as of electrons flying around the nucleus in smaller or larger circles, will not do. But it is tolerably certain that there are rings of electrons, sometimes with only one electron in the outer ring, sometimes with many. These rings are not arranged like the circles of seats in a circus tent, and the electrons do not go around like boys and girls perched on the horses of a merry-go-round. The rings may be all tangled up and stuck at all angles to one another; and even electrons of the same ring may not all fly round one after the other. *It is the alterations in the paths of these electrons which produce light.*

In the model of the atom which science has constructed in order to account for all the facts which radioactivity and the X-rays have made known concerning its structure, the electrons (or bits of negative electricity) are pictured as flying about in the atom as motor cars might run around a race track. The chief differences are that the speeds of the electrons are enormously greater, and the paths taken much more changeable.

HOW THE SUDDEN MOVEMENTS OF THE ELECTRONS PRODUCE LIGHT

What happens when an atom gives out light is that an electron which has hitherto been in an outer path suddenly hops into one which is nearer the centre. When it does this the atom ought to lose energy, because the path of one of its electrons has become shorter; but the energy itself is not lost. It escapes from the atom, and, assuming that it creates a kind of splash in doing so, the splash spreads outward like a wave. If, in another case, light is poured into the atom and the atom absorbs it, an electron will make room for it by jumping from an inner to an outer orbit. This surplus energy may presently be sent out again in its travels, as happens when such substances as luminous paint, having taken in light, *fluoresce,* or give it out again.

There is another view to be taken of the hops. In the first year of the twentieth century Professor Planck, the mathematician, showed that if hot bodies radiated away their heat energy gradually and equably, they would get cold faster than they do. He showed that they must part with their heat in a series of very small jumps. Now, heat is an oscillation. An atom contains, by virtue of its electrons, not an oscillation, but motion which, like an oscillation, runs in periods. Was it not likely that what was true about the departure of heat was also true about the departure of light from the atom? All the energy in a system like the atom, Dr. Planck suggested, was done up in tiny parcels which might be released one at a time or a million at a time; but the parcels themselves were not to be un-parceled, and they could get out only in jumps. This has proved to be, if not quite right, at any rate very nearly right. Light, we now say, is caused by the jump of an electron which sends out a jump of energy. This energy comes out in discontinuous bits, or in multiples of bits, and a bit is called a *quantum;* in packages we speak of *light quanta.*

DIFFERENT KINDS OF LIGHT PRODUCED BY THE ELECTRONS

What sort of light it is depends on the amount of energy set free when the electron jumps from one orbit to another; the jump's distance, or direction, may not always be the same. The ordinary kinds of light with which we are familiar—red, orange, yellow, green, blue, violet—are produced by an outer electron jumping to an inner orbit, but hardly to the innermost. It is an affair of the outer rings of the electrons.

The kind of light which is produced by the X-rays results from a disturbance of the inner rings of electrons. When this happens the release of energy is very much greater. We might, perhaps, go so far as to say that the parcels of energy are much more numerous. The same interval of time in which the change of orbit takes place, an interval so short that it cannot be reckoned, will be filled with the release of more packets of energy. In other words, they will be more frequent; and the waves which appear to be produced by them will be more numerous. In language which we have to use when speaking of light-waves, their wavelength will be much shorter. That is what is true of X-rays, and that is where they differ from ordinary light. Whether light is spoken of as waves, or as parcels of expelled energy, its radiation and impact will produce pressure.

How interested Newton would have been to learn about this pressure, which is true not only of light in the strict sense—that is to say, the waves that we can see—but of the other waves, rays or radiations that we cannot see. The proper name for it is *radiation pressure.*

HOW CLERK MAXWELL THOUGHT OUT WHAT TIME PROVED LONG AFTER

The famous James Clerk Maxwell, the original discoverer of the theory of electric waves, declared long ago that light must have a pressure, and stated how much that pressure must be. This he did by means of sheer thinking power, and because he had a true understanding of the nature of light-waves. Within the present century the late Professor E. F. Nichols and Professor Hull of Dartmouth

College found that radiation has a pressure just as Clerk Maxwell foretold.

When very careful and delicate experiments are made, and something that weighs very light is delicately hung by a slender thread made of quartz, so that the tiniest touch will push it, we find that it is pushed when a ray of light is allowed to hit it; and the force of the push can be measured, and proves to be exactly what it ought to be, to agree with the theory of light-waves. It is wonderful to see this experiment and to see something pushed as if a finger or a jet of water had struck it. We should remember the name of radiation pressure, for it is certain that every year we shall hear more about this subject.

A HOLE IN A SHUTTER THAT REVEALED THE MYSTERY OF THE UNIVERSE

Light is one of the greatest facts in the universe; and it is, therefore, one of the greatest facts of nature that light, wherever it flies, has a pushing power. Here is a force at work, almost as universal as gravitation, which acts in just the opposite direction, pushing instead of pulling. It is probable that the meaning and consequences of this pressure for the future of the universe are all-important, and we cannot help wondering what the mind of the discoverer of gravitation would have found out if he had known about radiation pressure.

The most famous of all Newton's experiments were perfectly simple, and cost scarcely anything to make. All Newton did was to close his shutters, bore a hole that let a ray of light through into the darkened room, and then take a prism or three-sided piece of glass, and see what happened when the ray of light passed through it. He found that the ray of white sunlight was broken up into many colors. When, in place of a hole, he made a slit in his shutter, and let the light pass through the prism, he found that the white light was broken up into a band of colors, which were the colors of the rainbow. This band of colors is now called the *spectrum*, and by it many mysteries of the universe have been revealed to scientists.

THE RAINDROPS THAT BREAK UP THE LIGHT AND MAKE THE RAINBOW

This experiment proved once and for all what could never have been guessed or believed—that the ordinary white light we know so well is a mixture of colors, and those colors are the colors of the rainbow. The rainbow itself is made out of white light, because the white sunlight is broken up into the colors that make it by being reflected from countless raindrops in the sky. These raindrops act as Newton's prism acted, and for the same reason. This great discovery of the nature of white light marks the beginning of this part of science.

Newton, of course, went very carefully into the matter; he understood what happened, and why. He saw that when the light passes through the prism it is bent. We know quite well how rays of light can be bent. As long as nothing bends them they travel in absolutely straight lines, but when they pass from air into water or water into air, or air into glass or glass into air, or in any other case, they are bent; so they come out from the prism at a different angle.

THE LITTLE BIT OF GLASS THAT SORTS OUT THE COLORS IN THE SUNBEAM

If that were all, the consequence would simply be that the ray of white light, instead of striking the wall just opposite the hole, as it would have done if the prism were not there, would strike it somewhere else, because the prism had turned its course. But, just because the white light is not a single thing, but a mixture of all the colors of the rainbow, something else happens.

The rays of light making these different colors will differ from each other in the extent to which they are bent. The red rays, as Newton found, are the least bent, and the violet rays are the most bent. The consequence is that the light which went into the prism all mixed leaves it all sorted out, the red rays being least bent from the course they would have taken if the prism had not been there, the violet rays being the most bent, and the others taking their places in between.

Not only did Newton discover this, but he laid down the law quite rightly, showing that the colors of light are not the consequence of anything it strikes on or passes through, but are the natural properties of particular kinds of rays. If a thing is red, that is only because it throws back to our eyes red rays. As he said, "some rays are disposed to exhibit a red color and no other; some a yellow and no other; some a green and no other; and so of the rest." He saw, also, that there is an absolute law as to the bending of these rays, the same color being always bent to the same degree, no matter where the light comes from.

THE GREAT MARVEL OF A LITTLE BAND OF COLOR

This simple experiment of Newton's has led to such a vast number of consequences that it would take a book to describe the merest outlines of them. In various parts of the world there are great observatories which are devoted to nothing else but repeating Newton's experiment with sunlight.

We already know that the band of color obtained is called a spectrum, and everything seen in this spectrum has to be studied and noted and described and measured; we have to analyze the spectrum as we would analyze a mixture of chemicals in a glass vessel. This subject is known as *spectrum analysis.* There is a picture of the colors of the spectrum facing page 3921.

This subject of spectrum analysis, as we have said, is engaging the attention of many advanced students of light. They have not found out everything that is to be known, but every year they are finding out more and more, not only about light itself, but about the composition of the universe in which we live. The instruments they use, known as the spectroscope, the spectrometer and the spectrograph, have enabled them to find out many things about the heavenly bodies which were unknown before. The work is very difficult.

THE DARK LINES WHICH MAY BE SEEN IN THE SPECTRUM

Spectrum analysis has to be applied not only to sunlight, but to the light from the planets; it has to be applied to the light from the stars and comets and nebulæ. We have to study the light given out by hot metals and minerals, and by every kind of lamp, or anything else that gives out light at all. In various ways we can study even the invisible part of the spectrum, the rays beyond the violet and below the red. With those beyond the violet we can take photographs, and we also find that those below the red convey heat.

In every part of the spectrum we find certain dark lines. Newton missed them, but they are almost more important and interesting than the spectrum itself. Every one of these lines tells us something about the nature of material that the light is coming from.

These dark lines are called Frauenhofer's lines because they were first really studied by Joseph von Frauenhofer, a German. This man was not a professor, but a working optician who had several important inventions to his credit. Because of these lines it has been possible to determine the presence of many of our common elements in the sun and the planets. It is pleasing to learn that the value of the work of Frauenhofer was recognized during his lifetime. He received many honors, and was buried in a plot of land given by the city of Munich.

HOW A PIECE OF GLASS CAN TELL US WHAT THE STARS ARE MADE OF

An analysis of the spectrum obtained by means of the prism teaches us of what elements the sun and the stars and other heavenly bodies are composed. It proves to us that there are oxygen and water in the air of Mars; it helps us to tell one element from another; to discover in one element the presence of smaller quantities of another element that we can detect by no other means; it even enables us to tell whether stars are moving toward us or from us in the very line of our sight, and at what rate they are doing so.

It was not really until the nineteenth century that the wave theory of light was established; and as we read all about sound in this book, it is worth knowing that it is the resemblance between sound and light which led the great Englishman Dr. Thomas Young to ask whether, notwithstanding Newton, light must not also consist of waves, as sound does. Young made the remarkable discovery that under certain conditions light added to light will produce darkness, because the waves of the one interfere with the waves of the other, as may happen with sound-waves, and as we see when water-waves are reflected from a breakwater or in the backwash on the beach.

Now, here we have not only a fact supporting the wave theory, but also a very interesting explanation of a certain difference between light and sound.

WHY A RAY OF LIGHT WILL NOT SPREAD OUT AND FILL A ROOM

If we let in a beam of light through a hole it certainly spreads out as it travels, but it does not at all behave as sound would. Sound would spread out equally in all directions, just as the light does from a candle standing in the middle of a room. But why does a ray of light remain narrow and not spread out sidewise, so that the ray of light does not fill a whole room from side to side and from floor to ceiling as sound coming through a hole would fill it?

The answer is that the waves going sidewise from a ray of light almost entirely interfere with each other. A light-wave does not move in the same way that a sound-wave does, and a picturesque explanation of the difference is given by a living English mathematician, Bertrand Russell. Suppose a procession is marching along a street and is now and again halted by the police at some point. Whenever this happens the people behind will press up till they, too, have to halt, and a wave of stoppage will travel down the procession as a similar wave does along the cars of a freight train when it stops. When the people in front move on they will thin out, and this process of thinning-out will also travel down the procession as the condensation due to stoppage did. These are what we called longitudinal waves, and sound-waves are like that. But light-waves are different. Suppose a mounted policeman rides along the right-hand edge of the procession. All the marchers will move away from his horse, as it passes, and this leftward movement will travel with the policeman along the procession. That is a transverse wave, though it moves with the procession, and light-waves are like that.

THE MOVEMENT IN THE ATOM WHICH MAKES MATTER LUMINOUS

We may think of all matter as made up of atoms deeply buried or surrounded on all sides by the ether, or by something which can be made to undulate by a movement arising from the atom. Now think of a fish under water moving its tail. If we are watching we may see ripples, that is to say, waves made in the water by the movement of the fish's tail. And so if the atoms of matter are acting in the same manner as the fish does when it moves its tail, they may set up waves in the ether just as the fish does in the water.

We are right to think of the matter in this case as made of atoms, and the atoms as being systems of electrons. It is the atomic systems themselves that are the source of light. A ball of iron might be set trembling, or vibrating, and in this way might cause waves in the air which we should call sound; but no possible movement of the ball as a whole would cause light. If, however, we heat the ball without moving it at all, something happens to the atoms of it or to the system of electrons within the atoms, and they release pulses of energy which we call light. If the ball is only fairly hot, the particular kind of waves in which these pulses of energy travel will be what we call red light; but if the ball becomes much hotter, it is then what we call white hot, for now its atoms produce that mixture of waves which we are accustomed to call white light.

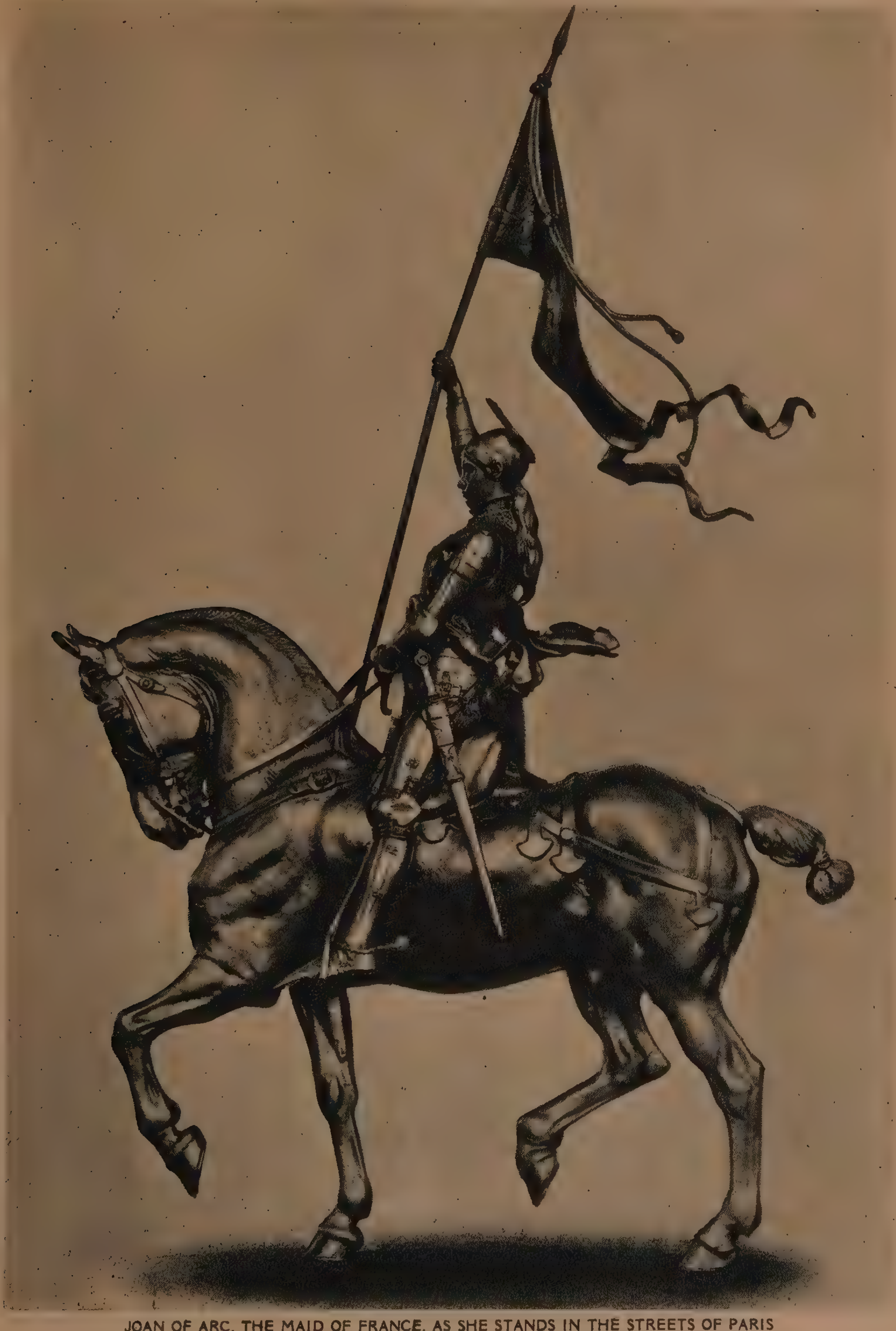
THE ATOMS THAT GIVE OFF THEIR OWN KINDS OF LIGHT

Now, if the iron ball is vaporized, the throbbing atoms make particular waves in the ether which can always be recognized and are always the same, whether the vaporized iron is shining in a laboratory or in a star millions of miles away.

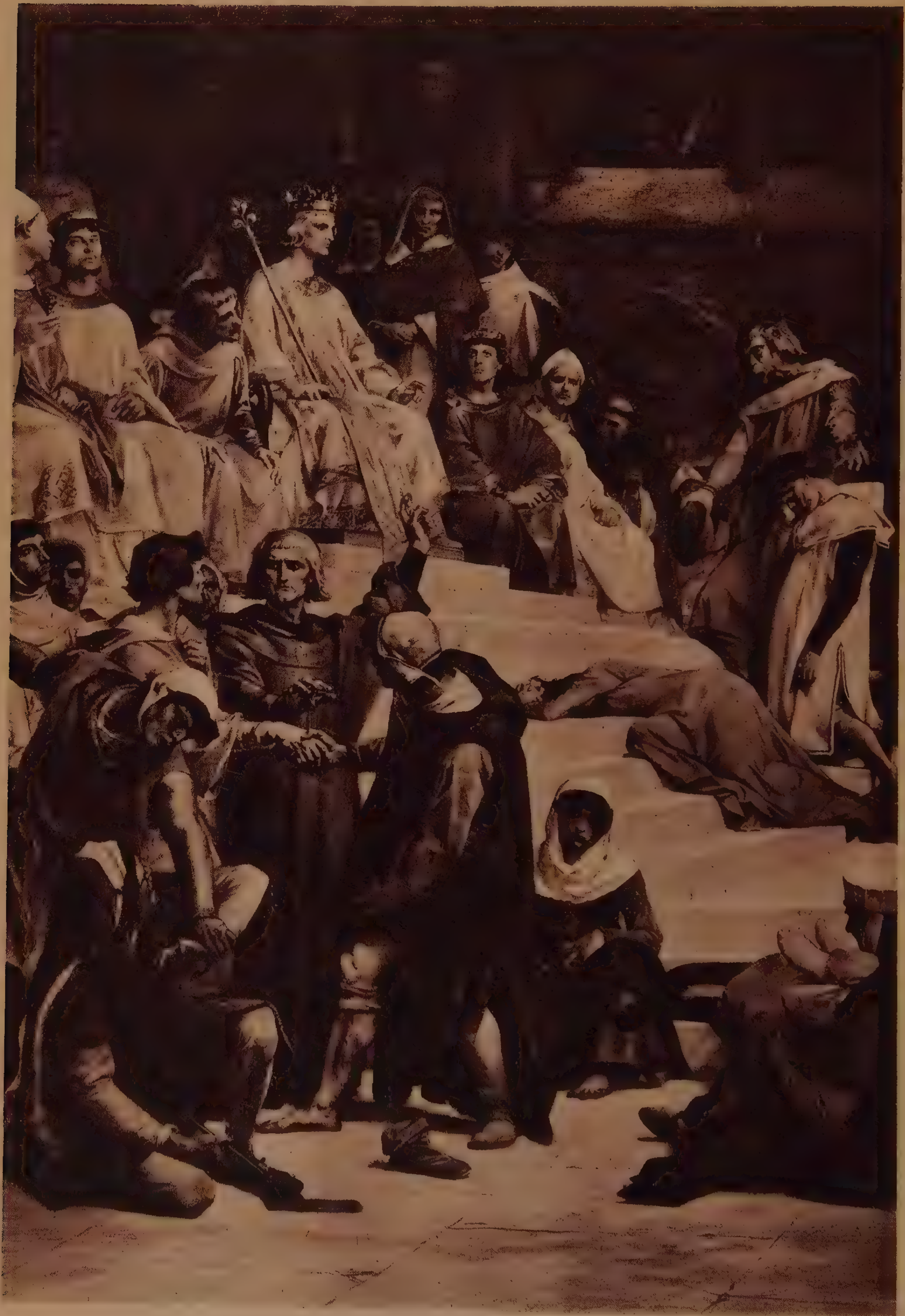
We can do this equally well whether we are studying the light from a hot wire in our room, or whether we are studying the light which left a star many hundreds of years ago; and we can say, in a true sense, that we see atoms of iron in that wire that is only a foot away, or in a star so far away that none of us can imagine its distance. Yet there is the evidence that such and such atoms, and no others, are giving forth light in that star; or, rather, were giving forth light from it years ago when the light which has now reached us left the star. The star may long ago have been smashed into dust and have disappeared. We cannot say of any star we see in the sky at this moment that it is now there; we can only say of the nearest we know that over four years ago it was certainly there.

It is a tremendous fact that every kind of atom known to chemists should be so specially different from all other kinds of atoms that it gives off light of a special kind. These different kinds of light are called the spectra of the various atoms or elements. Thus, there is a spectrum of iron, a spectrum of oxygen, and so on. In considering the nature of these we need not trouble for the present whether the wave theory of light or the modern additions to it is nearer the truth; it is sufficient for us here to speak as if the theory of wave motions in the ether were an exact law. At present this law is taken for granted, and it explains more facts than can be explained without it.

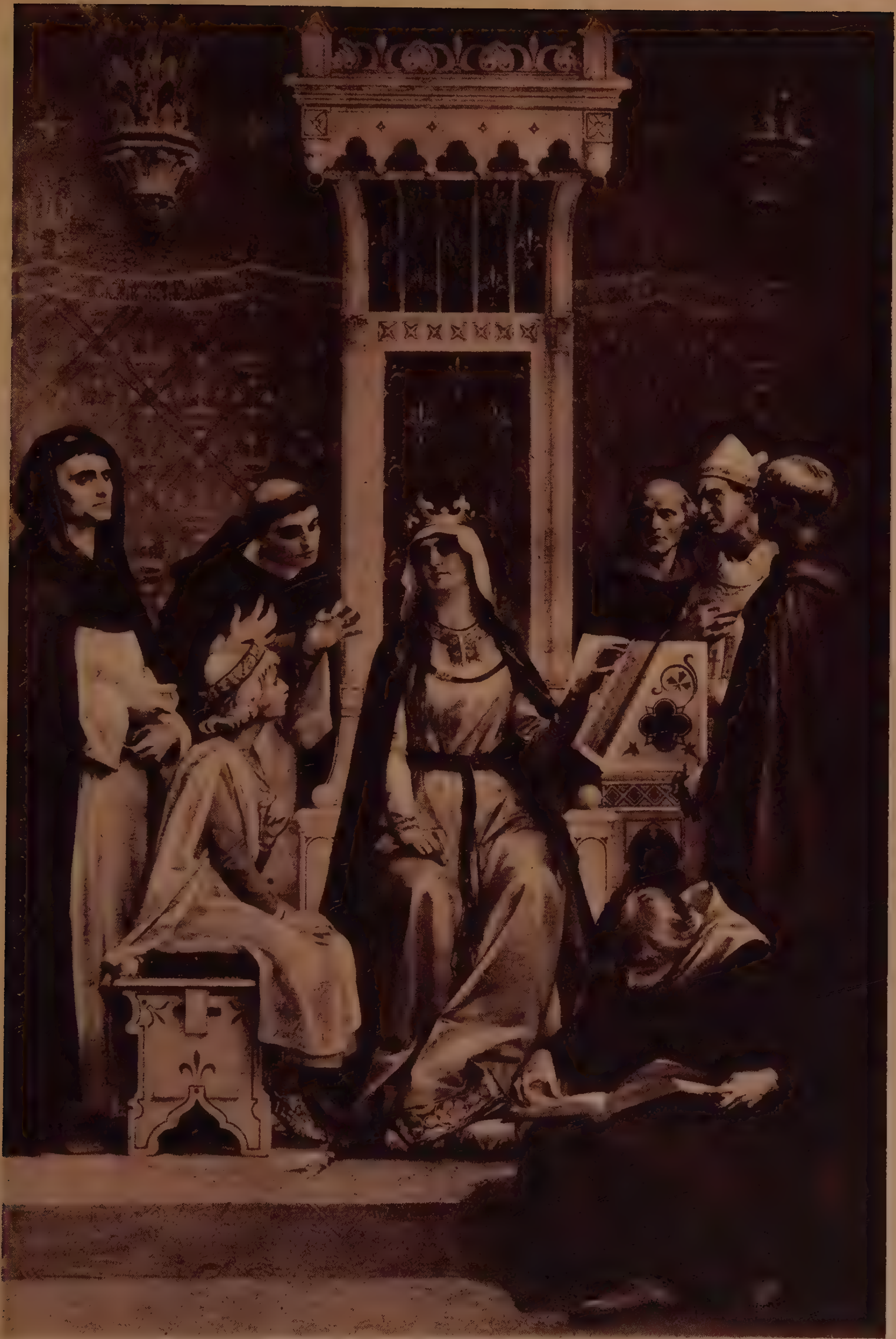
THE NEXT STORY OF THE EARTH IS ON PAGE 6079.



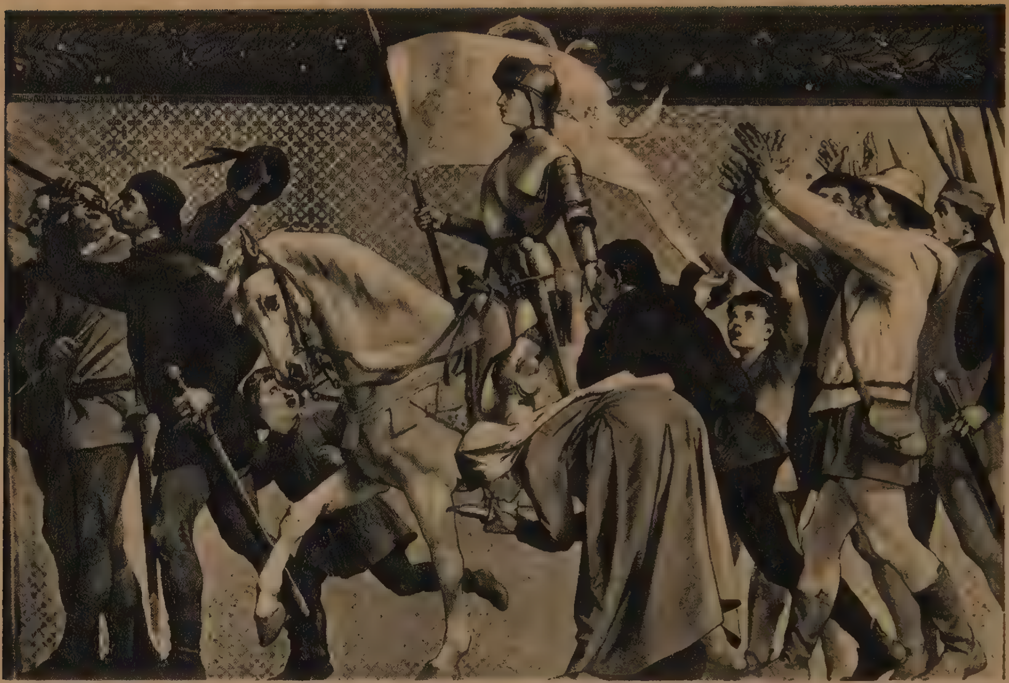
JOAN OF ARC, THE MAID OF FRANCE, AS SHE STANDS IN THE STREETS OF PARIS
This fine statue of Joan in battle array is by Emmanuel Frémiet.



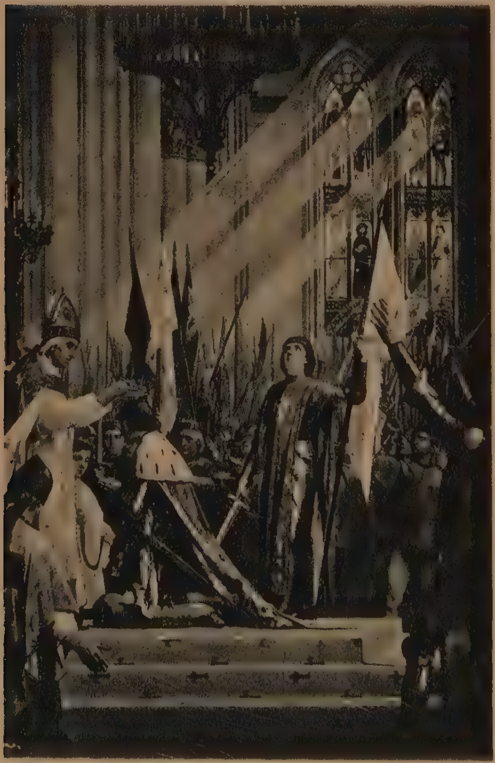
THE GOOD KING LOUIS IX DISPENSES JUSTICE. FROM THE PAINTING BY ALEXANDRE CABANEL, IN THE PANTHEON, PARIS



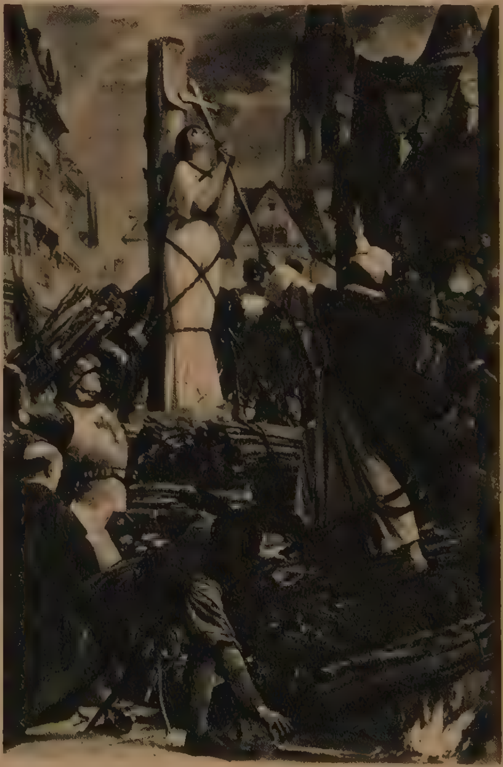
LITTLE KING LOUIS AND HIS MOTHER. FROM THE PAINTING BY ALEXANDRE CABANEL, IN THE PANTHEON, PARIS



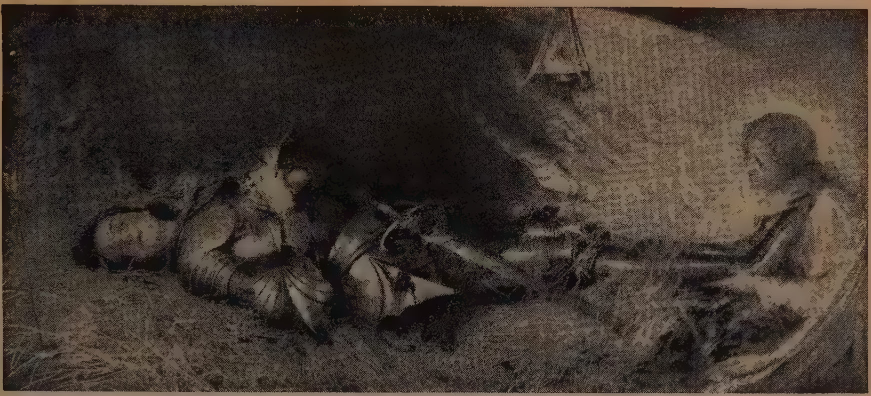
JOAN OF ARC WELCOMED BY THE POPULACE. FROM THE WALL-PAINTING BY JULES LENEPVEU, IN THE PANTHEON, PARIS



JOAN AT THE CORONATION OF THE KING AT RHEIMS, BY JULES LENEPVEU



THE LAST HOUR OF JOAN IN ROUEN MARKET PLACE, BY JULES LENEPVEU



The vision of Joan of Arc—From the painting by G. W. Joy.

ST. LOUIS AND ST. JOAN

TO our eyes French history has a way of looking like a tapestry. Her writers and scientists fade into the sober background, though they made as much history with their pens as the soldiers with their swords. It is the picturesque figures that stand out clearly for us in the pages of history —Charlemagne holding counsel with his Frankish peers in the orchard; St. Louis with the Red Cross burning on his shield; Joan of Arc raising her banner of the lilies; Catherine de Medici in her ruff and black gown; Richelieu the statesman in Cardinal's scarlet; Marie Antoinette wearing the feathers and satins and jewels of a doomed court; Charlotte Corday dying for the liberty she had gained for others, and Napoleon Bonaparte, that small, thick-set man in the cocked hat who rode his white horse across a Europe that was his battlefield.

No one will doubt that of all the men and women France has given to the world the most astonishing and beautiful is the shepherdess of Domremy; and next to her stands the Crusader King.

Because of their loveliness these two seem almost to be legendary characters to us. We are inclined to think of them as ideal creatures, people out of a poet's play or an old Italian fresco, heavenly bright, and unearthly. But we can read the chronicle of St. Louis, written by his best friend, Joinville; and we can read the actual words spoken in the inquiry that was made at the prayer of Isabeau D'Arc into the death of her daughter Jeanne. Monks, soldiers, herdsmen speak to us after all these years. These contemporary documents take away nothing of the beauty; they only make us feel that it was a beauty, not of marble or stained glass or painted canvas, but of flesh and blood. It was flesh and blood that could suffer like our own. They say that Joan wept when they told her she must die by fire, but it was flesh and blood inspired by a fervent faith that belongs to the very noblest children of France.

It is well to try to understand this spirit of France, and we cannot begin to do that without considering the lives of those two heroes who have ruled the imaginations of Frenchmen for hundreds of years.

Louis IX came to the throne when he was eleven years old. How many children would be ready to envy him! In 1226, they think, it was worth while to be a king; a crown was no mockery; the king's will was law to the nation. But let us see what kind of kingdom the schoolboy Louis inherited.

It was a kingdom entirely destitute of the things which make life worth living to us. Peace, safety, freedom of opinion—these things did not exist. The land was divided up among a group of barons, each as powerful as a petty monarch, each ambitious to grasp the crown for himself. As we read of plot and counterplot we think of the barons as a pack of savage dogs ready to fly at each other's throats, but first prepared to band together in attacking the lonely child who had strayed into their midst.

The boy had no friends, because his father had left a legacy of hatred behind him. Louis VIII had made war on his own people and persecuted them for their opinions. Every serf, as well as every ambitious baron, loathed the royal line.

THE MOTHER OF ST. LOUIS AND HER SPLENDID RACE IN HISTORY

Only a few years had passed since Arthur, the boy heir to the English throne, had been murdered, and his assassin had enjoyed the throne in safety. How was it that Louis escaped? The truth is that the story of St. Louis, like the story of so many great men, is the story of a mother. She who had soothed the troubles of his babyhood was to save him now.

Queen Blanche went to the young king's most powerful enemy, a man whose family had a long-standing feud with her own, and won him over to her little boy's side. A sharp struggle followed, but in the end the right prevailed, and Louis IX was established on his throne. Until the boy was old enough his mother governed France for him.

But her greatest achievement does not lie in that; it lies in the character of Louis. When we think of the violent past we imagine that gentle-hearted women in those times can have had no part in life beyond weeping and prayers. But history has left us two pictures of such women, still fresh and bright as miniatures in a missal. One shows us a Saxon lady calling a boy to her knee to look at a gaily colored book. "This shall be yours," she says, "when you can read." Thus were sown the first seeds of Alfred's learning. The other picture shows us Queen Blanche clasping her son to her with arms that almost bruise him. "Do you believe that I love you?" she asked. He would doubt anything but that! "Yet," said the mother, "I would rather see you dead than a sinner." Such work did women for England and for France in the dark ages past.

THE KING WHO LOVED HONOR AND JUSTICE RATHER THAN EMPIRE

Louis grew up into something new and amazing. He was a Christian king. It was an age when religion did not seem to keep kings from war, murder, robbery and oppression. They were all devoured with a desire to add to their possessions, by fair means or foul. Yet this new, strange character had no thought of wealth or empire. He cared for the poor, the helpless folk from whom he had nothing to fear! Surely he was mad!

But Europe soon perceived that the goodness of Louis was not weak piety. Only a man of iron will could have fought the firmly established feudal system as Louis did. One by one he drew its claws. Inch by inch he drove back the great lords and raised the poor serfs. He abolished the use of torture, trial by battle, and the persecution of a criminal's family. He reformed the currency. He recompensed those whom his father had persecuted. Justice and learning crept out of hiding into the sunshine of his reign. The people of England asked him to settle their disputes, knowing that his judgment would be the truest in Christendom.

So lovable a man could not fail to be happy in his wife and children, his subjects and friends; but when he had set France in order, he did not dream of a leisured happiness of his own. The ideals of the Crusade beckoned to him, as they beckoned to all the chivalry of his age. The kings and barons of Europe, enemies to one another, and many of them barbarous men, rode out to protect from desecration the grave of a carpenter's Son. Louis, at least, went out with pure intent.

HOW ST. LOUIS SET OUT TO CARRY THE CROSS TO JERUSALEM

This was the manner of his going. He fell ill, and at last was thought to be dead. A storm of weeping broke out, and somebody covered the king's face. But a woman snatched back the sheet, crying: "No! He will live to confound the enemies of God!" The dying king heard her; he rallied his failing powers and began to fight anew for life. When he had strength to speak he asked for the Red Cross, and lay holding it to his breast. As soon as he had recovered he announced that he would set out for Jerusalem at once. His family and friends sought to dissuade him: "You were delirious when you took the cross," they said. "You are not bound by such a vow."

THE GREAT KING WHO DIED PRAYING FOR HIS PEOPLE

But Louis would not hearken. He set out with his wife and young Joinville, the comrade who afterward wrote his life. Disaster came to the French forces, and Louis was taken prisoner. He might have escaped, but would not leave his friends. One day a party of assassins came to the dungeon to murder him, but they were overawed by his gentle fearlessness and would not do their work.

At last the desperate efforts of his wife and friend raised the huge ransom that set him free. Yet, when in 1270 he was called to lead a second Crusade, he left the peaceful land of France without complaint. Outside Tunis he was struck down by plague and had the agony of seeing his eldest son die of the same disease. When he knew that his own end was near he sent for his heir and pleaded with him to care for the poor, for justice and for peace. His very words are set on record. It is the language of a saint.

After he had done he asked to be carried from his royal bed to one of ashes. There, like a penitent, he lay praying for the people of France—that people before whom lay so many centuries of war and civil war, oppression and bloodshed. At last he was heard to murmur, "Jerusalem! Jerusalem," and with that name on his lips his crusader's soul sighed itself out.

THE DARK DAYS THAT HUNG OVER FRANCE WHEN JOAN OF ARC WAS BORN

The years passed, and again an hour of darkness came to France. At the end of a long series of wars with England she was almost completely subdued. The English regent held Paris and nearly every other important town. The rightful heir to the throne had fled to Poitiers, and by a disgraceful act of treachery his mother had bartered away his crown to England. The shame and helplessness of France was almost complete; in a few short years all this was changed by a laboring girl.

Historians may well speak of it as a miracle. Let a villager of Domremy, questioned in 1455, tell us of her childhood.

"Jeannette was born at Domremy, of Jacques D'Arc and Isabeau, his wife, laborers. . . . My father's house joined the house of Jacques D'Arc, so I knew her well. We often spun together. . . .

"She employed herself at home with many duties in the house, spinning hemp or wool, following the plow or going to harvest, according to the season. When it was her father's turn, she sometimes kept the cattle and the flocks of the village for him. . . . She was a good girl, simple and gentle. Often she was bashful when others reproached her with going too devotedly to church.

"She liked to take care of the sick; I know this of a surety, for, in my childhood I fell ill, and it was she who nursed me. . . . There is a tree by us called the Ladies' Tree. I have heard that the fairies came there long ago to dance. The young people of the village were accustomed to go to this tree, taking food with them. I often went there with Jeanne, who was my friend, and with other young girls. We sat there, ran about and played."

THE MYSTERIOUS VOICES THAT CAME TO JOAN IN HER FATHER'S GARDEN

Joan was born on January 6, 1412. Very early the shame and sorrows of France became her own. Every week there came news of a battle or a siege or a pillaging. She brooded over these things at her work. When she was thirteen she heard a mysterious voice. "It was midday, in the summer, in my father's garden," she told her judges. "I was very much frightened. It seemed to me to come from lips I should reverence. I believe it came to me from God." From that time until the end of her brief life Jeanne was always guided by this voice from the other world.

Socrates heard such a voice. Mystics all down the ages have had visions. In poetry we sometimes come across a passage of such beauty as makes us feel that the poet was inspired from another world:

Though inland far we be,
Our souls have sight of that immortal sea,
Which brought us hither.

Because so few are pure enough to hear this voice, those who are deaf to it may choose to believe it has not spoken.

In that case they must find another explanation for the miraculous facts of Joan's life.

The voice that came to the laborer's child told her that she would save France. She received the message with a humility that never deserted her. God had chosen the lowliest of his children to accomplish His purpose for France. She never thought she had any merit of her own.

Domremy lies in a little valley of Lorraine. "You must go into France!" the voice urged her, more and more instantly. In 1428 her instructions became definite. She was to go to Robert de Baudricourt, captain of Vaucouleurs, and ask him to lead her to the Dauphin. The Dauphin was to give her an army. She was to raise the siege of Orleans and lead the king to his crowning at Rheims. "I could stay no longer," she said to her judges. She set off for Vaucouleurs with a kinsman—the kinsman who bore witness that "many times Robert told me to take her back to her father and to box her ears."

JOAN'S JOURNEY ACROSS FRANCE TO BRING HELP TO THE KING

A knight called Jean de Metz afterward described how he saw her there wearing "a red dress, poor and worn." He asked what she wanted.

"I am come here," she answered me, "to speak to Robert de Baudricourt, to the end that he may conduct me or have me conducted to the king; but Robert cares neither for me nor for my words. Nevertheless, before the middle of Lent, I must be with the king—even if I have to wear my feet to the knees! No one in the world—neither kings, nor dukes, nor the daughter of the king of Scotland, nor any other can recover the kingdom of France; there is no succor to be expected save from me; but, nevertheless, I would rather spin with my poor mother—for this is not my proper estate; it is, however, necessary that I should go and do this, because my Lord wills that I should do this."

THE LITTLE SHEPHERDESS WHO BECAME A MIGHTY CAPTAIN

At length she convinced the captain. He gave her man's clothing, a horse and an escort. It was an eleven days' journey to Chinon, in great peril from the English and their allies of Burgundy, but Joan came safely at last into the presence of the Dauphin.

They sought to deceive her, but she knew him at once and delivered her message. He was as unwilling to believe in her as De Baudricourt had been. For three weeks she was closely examined by lawyers and theologians. One of the courtiers speaks of her as a "poor little shepherdess." Yet she convinced them.

There was something more than human about this stainless maid. She reformed the swearing, intemperate and disheartened army. She inspired it. She brought volunteers from every side. She overruled the counsel of old soldiers, and her generalship was right. The Bailiff of Chartres said: "Apart from affairs of war she was simple and innocent, but in the conduct of troops, and in actual warfare, in the ordering of battle, and in animating the soldiers, she behaved as the most skillful captain in the world."

In three months she had raised the siege of Orleans, taken Troyes, won the battle of Patay, and led the Dauphin to his crowning at Rheims.

This her Voice had promised, and this she achieved. Now she wished to go home, as one whose work is done, but the king forced her to stay. Then, instead of following her counsel, which was unflinching resistance to the English, he yielded to other advice and tried to patch up peace. He was lazy, hesitating and timorous; his father was insane, and his mother was a traitor. It was not surprising that at last, hampered by foolish orders, Joan was betrayed into the hands of the enemy at Compiègne. She was trying to regain the town, but a party of Burgundy troops reached the bridge before her. She was cut off, and after a sharp struggle was thrown to the ground and made captive.

THE STAINLESS STANDARD THAT CARRIED ALL BEFORE IT

Before we pass on to her prison life let us listen to what her comrades have to say of her conduct in war. Her page tells us how she sprang up from sleep one night crying, "French blood is being spilled!" how he sought her horse, while the women of the house hastened to arm her; how he passed her banner to her out of the window, and how, seizing it, she cantered to the danger point, and brought victory with her. She always carried a standard so that she need not take the sword. "I have never killed anyone," she proudly told her judges.

THE WONDERFUL ANSWERS OF JOAN THAT BAFFLED HER JUDGES

She was purchased by the English from Burgundian soldiers for a king's ransom, about $80,000 in modern money. The soldier who took her was given an annuity of $1,500! When she fell ill in prison a doctor was summoned. She was not to die a natural death: "she had cost too dear for that"; and she was not to die "except by justice and the fire."

Joan's trial was in every way illegal, but the lawyers who were brave enough to protest were threatened and coerced. She was imprisoned with a constant guard of five English soldiers of the lowest blackguard type. She was insulted, ill-used and heavily shackled. She was subjected to long hours of subtle questioning by learned theologians, who had promised their foreign master to procure her death.

So wonderful were the peasant girl's replies that it was months before the infamous Bishop of Beauvais could trap her into something which gave a shadowy excuse for their sentence. According to honest Notary Manchon, who took down the evidence at the trial, they falsified the records and sent a spy to her as a confessor. In their own official account it is told how they took her to the torture chamber, but she said: "Truly if you were to tear me limb from limb, and separate soul from body, I would tell you nothing more!" The report concludes: "Seeing the hardness of her heart and her manner of replying, we, the Judges, fearing that the punishment of the torture would profit her little, decided that it was expedient to delay it, at least for the present."

JOAN IS LED OUT TO DIE IN THE STREETS OF ROUEN

At length, in 1431, a year after her capture, she was led out to die. It was at Rouen, the seat of the English regent's government. Crowds filled the market square. The judges sat on a platform. Many witnesses said: "I could not see her die, for compassion." For a month afterward Manchon could not feel at peace.

Joan had exclaimed: "I would rather be beheaded seven times than burned!" but her voices had bidden her—"Be resigned; have no care for thy martyrdom; thou shalt come in the end to the Kingdom of Paradise." She was calm now and listened patiently to the sermon which was preached before the fire was lighted, silent through its abuse of herself, till the preacher included the French king in his condemnation. Then she cried out in his defense, loyal to her false master to the end.

Several judges were moved to tears at the sight of this girl of twenty being prepared for a frightful death, but none spoke a word for her. A priest who sought to comfort her on the scaffold was hustled by soldiers who exclaimed: "Wilt thou have us dine here?"

Two sergeants hurried her to the stake. She begged for a cross, and an English soldier made one of two pieces of wood. She put it next to her heart. A monk brought the great cross from a church near by and held it toward her as the flames rose. She was heard calling on Jesus.

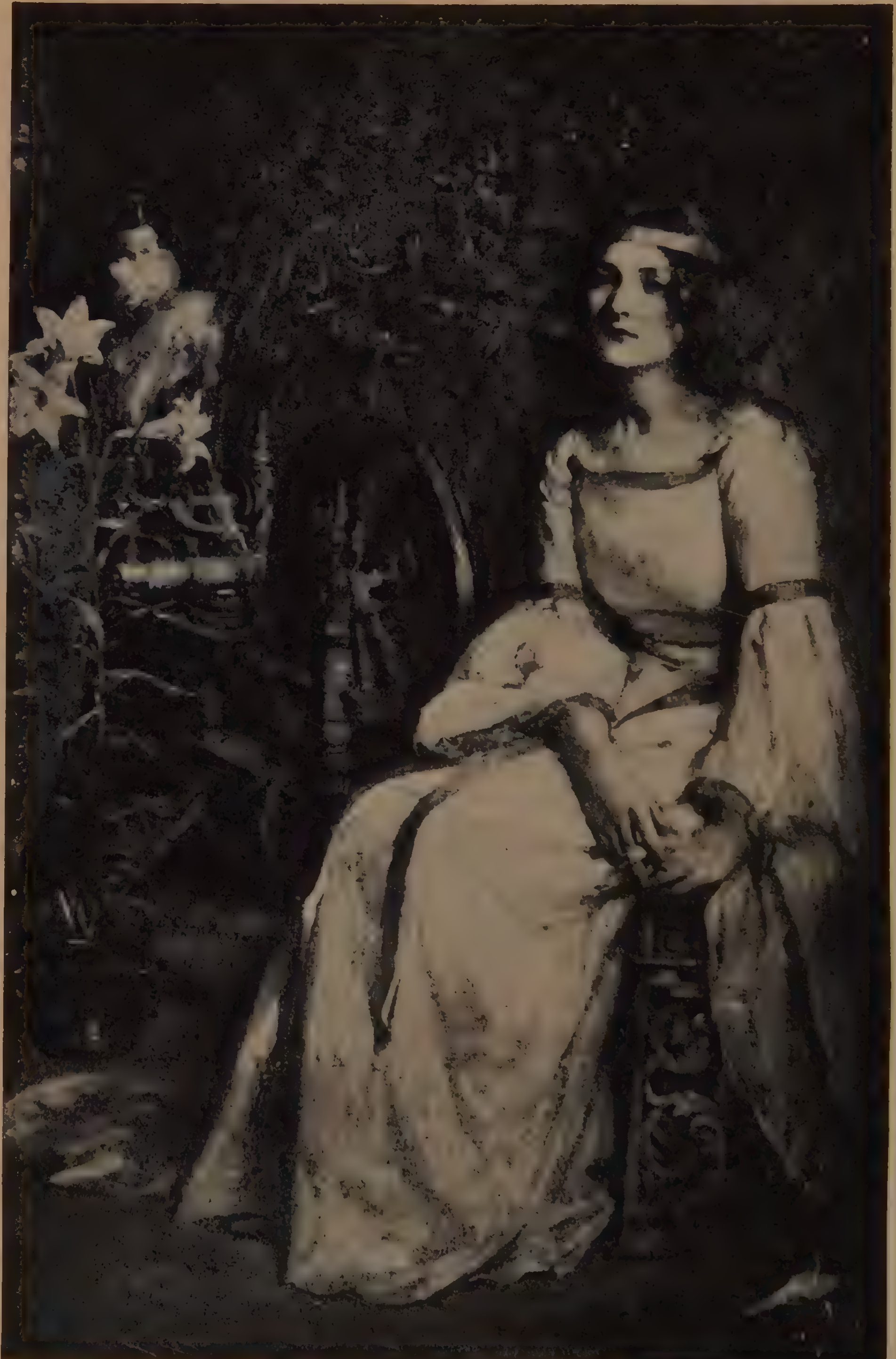
Joan's life did not end in defeat. She had come to a France in despair, almost bereft of hope and courage, and half resigned to foreign servitude. She made France a proud nation once more; she planted in it a new patriotism. The invaders were at length driven out of the land, but the victor was not Charles, the living king; it was the peasant girl whose ashes he had thrown into the Seine.

THE DEATHLESS GLORY THAT CROWNED JOAN OF ARC

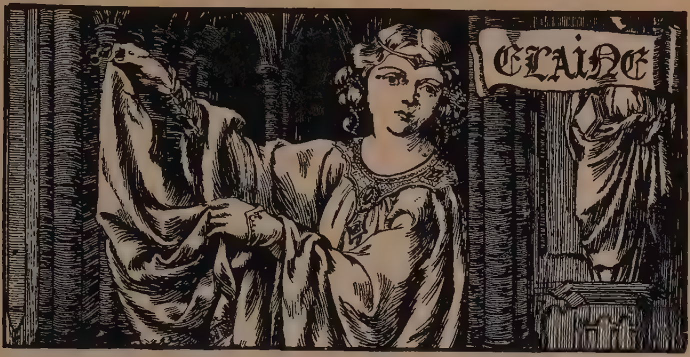
The execution took place on May 30, 1431. For several years efforts were made to impress upon the French people the fact that Joan's death had been just. But the people would not listen; already they had begun to reverence her as a martyr. Twenty years later, as a result of a petition of the D'Arc family the pope held a new trial and pronounced Joan innocent. The succeeding centuries saw grow up in France and other countries a cult of the Maid of Orleans. Her life and death were the inspiration for many books, poems and plays.

In the middle of the nineteenth century the pope was petitioned to take steps to canonize Joan. In 1909 the Maid of Orleans was beatified, and on May 16, 1920, almost five hundred years after her martyrdom, she was canonized and became St. Joan. The ceremony took place in the historic basilica at Rome, and was attended by thirty thousand people from all over the world.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 5915.



"ELAINE THE FAIR, ELAINE THE LOVABLE, ELAINE THE LILY MAID OF ASTOLAT"
From the painting by Mouat Loudan.



THE LILY MAID OF ASTOLAT

THERE lived in Astolat, in the days of King Arthur, a brave old lord with his two sons and a daughter so fair that she was called the Lily Maid.

For so rare was this Elaine that she filled the eye with the whiteness of a lily, and the soul with fragrant thoughts of goodness and of love. She was but a child, a tender maid, and yet she kept the house for the old lord, her father, upon whose knee she would climb for caresses. To her two brothers, just beginning to dream of knighthood, the Lily Maid was like a mother. Over all in that castle she exercised the sway of a pure heart and a most lovely soul.

Happily passed the long summer days. What could ever break the spell of that greenwood peace, that hearthside happiness? The little mother of the castle had ever a song on her lips. the two brothers loved to have her watching their sword-play, and her old father found his age sit light upon his shoulders because in the maid he saw again the loveliness and sweetness of the wife who awaited him in heaven. What could ever break the spell of that joyful happiness?

One day there sounded in the courtyard the clatter of a horse's hoofs, and presently there strode toward the door a mighty armed figure, with shield and spear, the blazoned shield dented by many strokes, the sun-burned cheek of the warrior scarred by a sword-cut. He revealed not his name, but asked of the Lord of Astolat a favor.

"I go to joust," said he, "for King Arthur's diamond; but because men say it is my name rather than my spear that gets me triumph, I would go this time secretly and unknown. Therefore, good lord, let me, I pray you, leave here my blazoned shield, well known at Arthur's Table, and take with me hence one that is innocent of all device, that no man may know me."

The little maid looked at the knight, and her heart leaped up in her bosom. The Lily Maid looked upon Lancelot —the brave, noble, but world-stained Lancelot, though she knew not his name—and loved him for the carriage of his head, the aspect of his eye, the steady music of his voice. Never had she looked upon man so near divine. To the simple maid the war-scarred soldier thrice her age was as a god from heaven.

While he stayed at the castle she looked upon him much and loved him more; and when he left his shield with her she gave him a broidered sleeve to wear in the tournament, "for my sake." The great Lancelot laughed lightly, for never had he worn lady's favor, his heart being given in secret to Queen Guinevere; but as one humors a child, so he took the pretty sleeve and bound it round his helmet, and rode away with one of Elaine's brothers as his squire.

Then Elaine watched over the shield Lancelot had left behind, and learned to know every mark and wound upon it, and the more she dwelt upon the scars, the more she loved the great, stern knight who had outlasted such deadly conflict. His eyes came to her in her dreams. His voice was always in her ears. Poor maid, poor Lily Maid of Astolat!

The days passed, and at last there came a knight of Arthur's Table to Astolat, bearing with him the diamond. He said that he had thought to find there Lancelot, who had been wounded and would no doubt presently return to claim his shield. When that occasion came, said he, let the diamond be given to him, for now King Arthur knew his name. So spake the knight, and rode away.

Then Elaine, knowing at last the name of her hero, cried to her father that she might go and seek him with the diamond, and he suffered her. So with her brother she set out, and came at last where Lancelot lay sick unto death in the cave of a hermit.

The Lily Maid approached the bed whereon the pale knight lay, and, her heart swelling with love, laid the diamond in his hand.

Her face was near, and as we kiss the child
That does the task assigned, he kissed her face.
At once she slipt like water to the floor.
"Alas," he said, "your ride hath wearied
you!"

He did not know how she loved him; his man's heart could not guess the depth of this pure maid's worship. He treated her like a child. And when he grew well, and she saw that he did not know, and that he might ride away without a word to her, she told him of her love. But Lancelot smiled upon it as a mere fancy that would pass, called her "child," bade her love one more worthy of her, and in his heart sighed for the love of Guinevere.

Then Elaine cried that she could not live without him; that if she might not be his wife, he would let her at least go with him through the world. All this the great knight treated as the fancy of a child.

"It will pass," he told her. "I have known such flashes in my own youth."

And then, because her nursing had given him back his life, he declared to her that when she came to marry one of her own age he would bestow upon her half of his territory, and that he would be always her knight, with sword and spear held ready at her service.

While he spoke
She neither blushed nor shook, but deathly
pale
Stood grasping what was nearest, then replied:
"Of all this will I nothing"; and so fell,
And thus they bore her swooning to her tower.

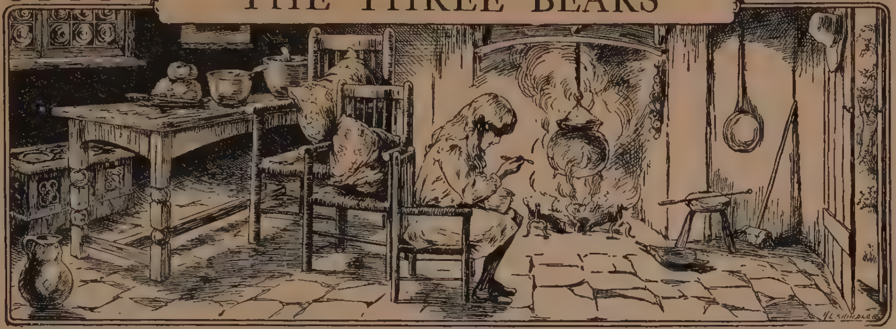
Then the old Lord of Astolat came to Lancelot, saying: "Use some roughness to her; peradventure, then the love she bears thee will return to her bosom." But Lancelot could not speak harsh words to the Lily Maid; yet when he rode away he took no leave of her, and she, who had never guessed that her so great love could be despised and cast aside, looking down from her window, saw him depart without a word. Her heart broke within her. She had given all her love to him, given all herself; there was nothing now—nothing. The old lord and his two sons, watching the maid, saw her fade swiftly to her death.

Lancelot at Arthur's court forgot the Lily Maid and gave himself up to the delights of converse with the beautiful queen. His wound was healed, his health returned: he began to take pleasure in life. Far away in his memory dwelt the kindness and sweetness of the simple little maid who had so innocently offered him her love.

One day, as he sat with Queen Guinevere, they looked from the window and saw a great barge, solemnly draped, floating toward the castle; and the barge carried a maiden's bed, and on the bed lay the Lily Maid of Astolat in royal robes, with her golden hair spread upon the pillow, a lily in one hand and a letter in the other. And this was the letter, which King Arthur read aloud when the lovely maid had been solemnly borne into the hall, and while Lancelot mused upon the childlike innocence of her face and remembered all her love for him:

Most noble lord, Sir Lancelot of the Lake,
I, sometimes called the Maid of Astolat,
Come, for you left me taking no farewell,
Hither, to take my last farewell of you.
I loved you, and my love had no return,
And therefore my true love has been my death.
And therefore to our Lady Guinevere,
And to all other ladies, I make moan:
Pray for my soul, and yield me burial.
Pray for my soul thou, too, Sir Lancelot,
As thou art a knight peerless.

THE THREE BEARS



GOLDILOCKS TOOK UP THE SPOON AND ATE UP ALL THE BABY BEAR'S DINNER

THREE bears lived in a house in a wood. There were the father bear, the mother bear, and the baby bear. The first was a great big bear, the second was a middle-sized bear, and the third was a tiny wee bear.

In the kitchen was a table, and beside the table there were three chairs. The first was a great big chair, the second was a middle-sized chair, and the third was a tiny wee chair.

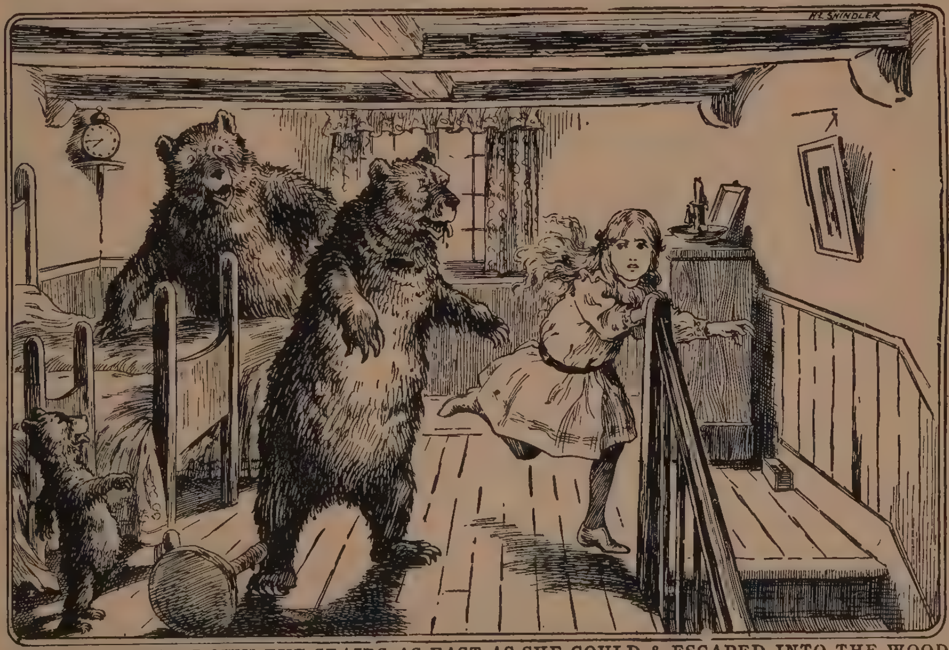
One day the three bears went out for a walk. Before they started, mother bear prepared the dinner and poured it into three basins, to be ready on return. The first of these was a great big basin, the second one was a middle-sized basin, and the third one was a tiny wee basin.

While they were out a little girl named Goldilocks passed by that way and looked in at the window. She was very cold and hungry, and the bread and honey in the basins looked very tempting. So she pushed open the door and walked in.

"How good it smells!" she said. And she sat down in the great big chair, but it was much too large for her. So she tried the middle-sized chair, but that was too high for her. So she sat down in the tiny wee chair, which just fitted her.

She took up the spoon and soon ate up all the little baby bear's dinner.

When she had finished, she began to feel very tired, and thought she would like to lie down. So she went upstairs



GOLDILOCKS RAN DOWN THE STAIRS AS FAST AS SHE COULD & ESCAPED INTO THE WOODS into the bedroom, where she found three beds. The first was a great big bed, the second was a middle-sized bed, and the third was a tiny wee bed. First she tried the big bed, but it was much too big. So she got out again and tried the middle-sized bed, but that was too big. So she jumped into the tiny wee bed and fell fast asleep.

Soon the bears came back, and as their walk had made them very hungry, they went straight up to the table to find their dinner.

"Someone's been sitting in my chair," cried the great big bear in a great big voice.

"Someone's been sitting in my chair," cried the middle-sized bear in a middle-sized voice.

"And someone's been sitting in my chair," cried the tiny wee bear in a tiny wee voice.

Then they looked into their basins.

"Someone's been tasting my dinner," cried the great big bear in a great big voice.

"Somebody's been tasting my dinner," cried the middle-sized bear in a middle-sized voice.

"And somebody's been tasting my dinner and eaten it all up," cried the tiny wee bear in a tiny wee voice.

"Who is it?" cried all the bears together. And they all ran upstairs. The great big bear ran to the great big bed.

"Somebody's been lying in my bed," he cried in a great big voice.

The middle-sized bear ran to the middle-sized bed. "Somebody's been lying in my bed," she cried in a middle-sized voice.

And the tiny wee bear called out in a tiny wee voice: "And somebody's been lying in my bed—and, oh, here she is!"

Just at that moment Goldilocks woke up suddenly and saw the three bears looking angrily down upon her. She was so frightened that she jumped out of the bed and ran down the stairs as fast as ever she could, and out of the house into the wood, and the bears never saw Goldilocks again.

THE EMPEROR AND HIS SERVANT

A POOR man went to the palace of the emperor and asked to be engaged as a servant. "What can you do?" inquired the emperor.

"I can act as bodyguard to your Majesty," he said. "I can watch when others sleep, and sleep when others watch; I can drink a beverage and tell whether it be good or not; I can invite suitable guests to a feast; and I can make a fire without smoke."

The emperor engaged the man, and, first of all, he was employed as bodyguard. Every night after the ruler had retired he lay at the door, fully armed, with a dog who would bark if anyone approached.

So well did he do this that after a year the emperor told him to perform his second task. The man carefully collected, during the summer, a vast store of necessary things while others were engaged in pleasure, and then when winter came he was able to take his ease while the others worked.

"Now," said the emperor, "drink this cup of wine that I have had prepared, and tell me what you think of it."

The man drank it quickly and said: "It was good; it is good, it will be good."

"Explain!" said the emperor.

"Well," replied the man, "the cup contained vinegar, old wine and new wine. The vinegar was good before it turned sour, the old wine is good, and the new wine will be good when it has matured."

"Perform your fourth task," said the emperor. "I will give a feast; invite suitable guests to it."

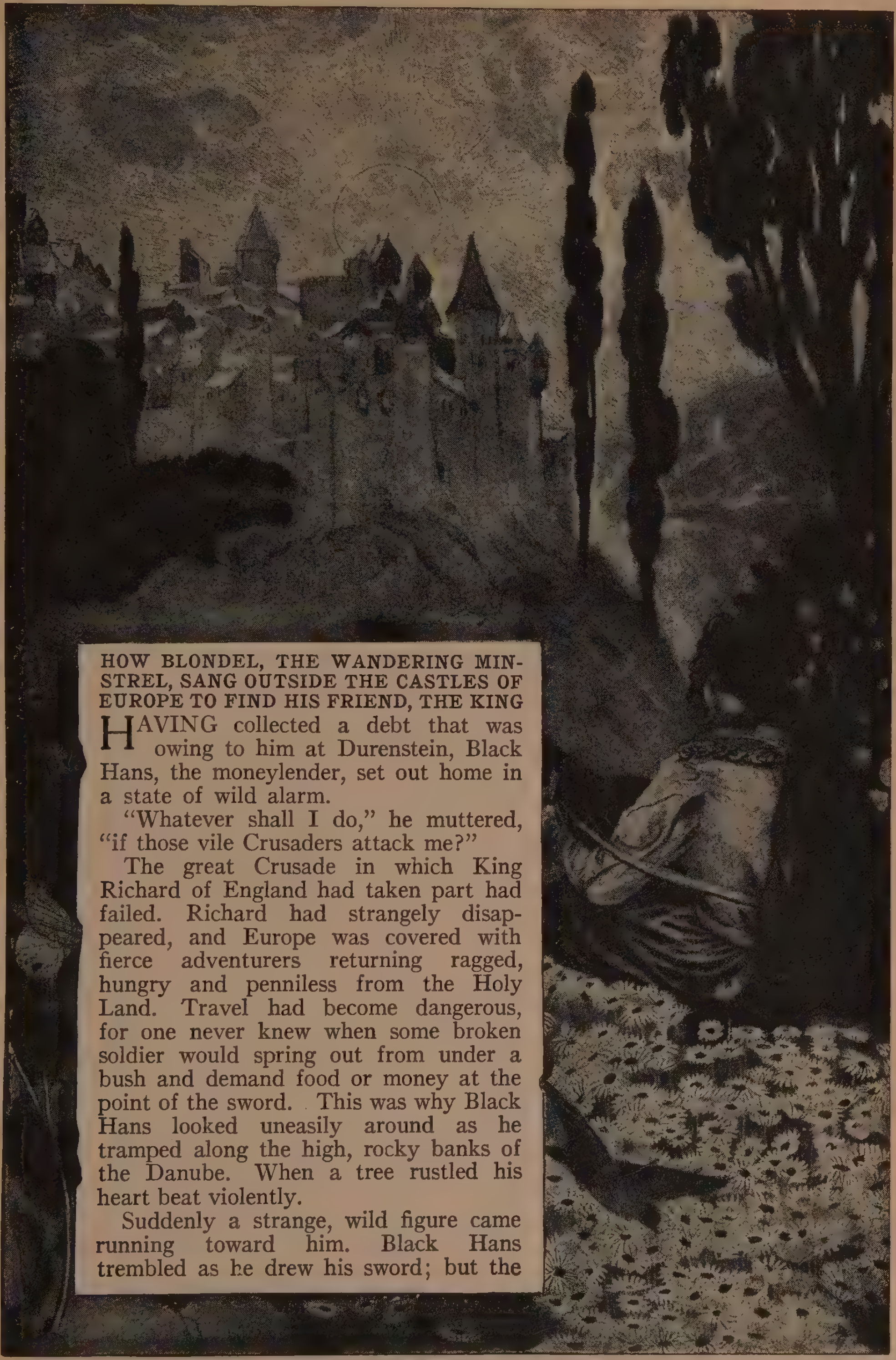
The man went out and invited only the emperor's enemies. When his master saw the guests he was very angry. But the man replied: "Sir, I invite your enemies because, by showing kindness to them, you will make them friends." And so it proved.

The man was now asked to carry out the fifth task—that of making fire without smoke.

"It shall be done at once," he replied. And taking thin twigs that had been thoroughly dried in the sun all the summer, he applied a light, and they blazed up without smoldering and smoking.

The emperor was so pleased with his intelligence that he promoted him to a high office.

THE SONG THAT FOUND A KING



HOW BLONDEL, THE WANDERING MINSTREL, SANG OUTSIDE THE CASTLES OF EUROPE TO FIND HIS FRIEND, THE KING

HAVING collected a debt that was owing to him at Durenstein, Black Hans, the moneylender, set out home in a state of wild alarm.

"Whatever shall I do," he muttered, "if those vile Crusaders attack me?"

The great Crusade in which King Richard of England had taken part had failed. Richard had strangely disappeared, and Europe was covered with fierce adventurers returning ragged, hungry and penniless from the Holy Land. Travel had become dangerous, for one never knew when some broken soldier would spring out from under a bush and demand food or money at the point of the sword. This was why Black Hans looked uneasily around as he tramped along the high, rocky banks of the Danube. When a tree rustled his heart beat violently.

Suddenly a strange, wild figure came running toward him. Black Hans trembled as he drew his sword; but the beggar laughed, and, approaching closer, held out his weapon for him to look at. It was only a simple lute such as minstrels used in those days to sing to.

The man himself was tall and young and handsome, with long fair hair; but his cheeks were lean and worn, and his dress was a flutter of rags.

"My good sir," he said, taking off his cap with an air which would have been dignified in a lord, but was ridiculous in him, "I do not want to fight you or beg from you. At least," he added, "I only want to beg a little information. That will cost you nothing. Is there a castle near by where I could get food and lodging in return for a display of the gay science?"

"The gay science?" exclaimed Black Hans, looking at the miserable figure before him. "What is that?"

"Oh, you boors! You ignorant German boors!" cried the ragged minstrel angrily. "The gay science is the name of the new sweet poetry invented in sunny Provence. Have you never heard of Richard, the poet-king of England, who has made the gay science known from London to Palestine?"

"What about Richard of England?" said the moneylender suspiciously. "Are you looking for him?"

"What has a beggar like me in common with a king of England?" said the minstrel, with a laugh. "I am looking for food and lodging, my friend. Am I likely to get them about here?"

"Well, there's the Castle of Durenstein about a league up the river," said Black Hans sullenly. "But I doubt," he added, as he moved rapidly away, "if they want any of your new French fashions of singing and playing."

When the moneylender was out of sight, the minstrel threw his lute away and flung himself on the ground, under a tree, and covered his face in his hands and wept bitterly.

"My search is all in vain!" he moaned. "Richard, my Richard, I would give my life to find you and help to set you free! But it is impossible! You must have been shipwrecked on your way from Palestine, and the tale about a secret prison is a false report made by your foes to hurt your friends and waste their lives."

For a long time Blondel lay flat on the ground, choking with sobs. He was a young knight of Picardy, who, like many other great lords of his time, had taken to the pleasant life of a high-born minstrel. In a tournament of song in southern France he had met Richard, and won from him the prize for singing; and, instead of disliking Blondel for excelling him, the brave and large-hearted king of England had given him lands and made him his companion. They had lived together, composing songs in the new fashion and setting them to music and singing them to one another.

As Blondel met with an accident, he could not go with Richard to fight with him in the Holy Land; but when a rumor spread in Europe that the king had been captured and secretly imprisoned on his way back to England, the brave minstrel-knight resolved to venture his life in finding where his king was hidden.

"It's no use crying and moaning," he said at last, rising up resolutely and looking about for his lute. "Tears will not find his prison or unlock the gate. And, first of all, I must get some food, for I am well-nigh starved to death."

He had been wandering a long time since he set out from Picardy on his search, dressed in his brightest and gayest robes. Now his shoes were worn from his feet, and his fine attire was torn into tatters. In his own country the minstrel was always an honored guest, and had his seat at the lord's table and the best of food and lodging. Now as he went on he found that instead of being received honorably in the great halls of the castles as a minstrel-knight, he had to slink into kitchens, where his songs usually won for him a supper and a bed.

Walking along the narrow gorges through which the Danube foamed and roared, he came into the wide plain of Vienna.

There, where the great river widened, was the Castle of Durenstein rising above the top of a hill and surrounded by a wall of rugged rocks. At the foot, by the bank of the river, was a little village. Blondel had enough money to buy some wine and bread at the inn in the village; then, refreshed by his meal, he wandered for some time around the castle singing at the top of his voice.

In a low, dimly lighted room in the castle-keep a tall powerful man, with a finely cut face and a head of auburn hair was restlessly pacing up and down the room, talking passionately to himself.

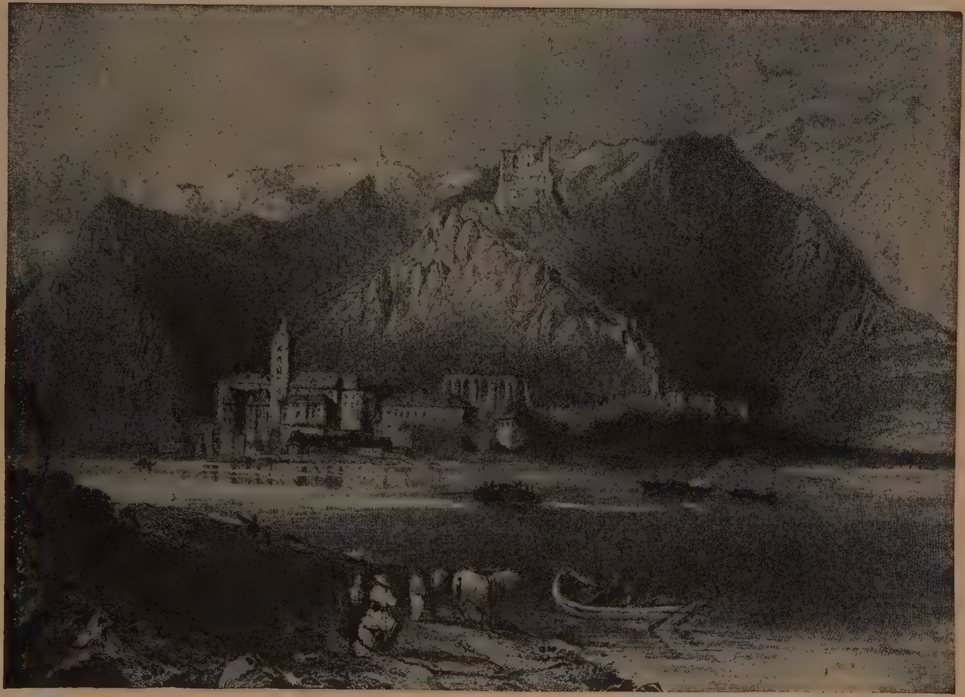
"Two years! Two years!" he was saying bitterly. "And not a single man in all my dominions has tried to set me free! I shall go mad if I think much more about it. There's John, my brother, and the Earl of Northumberland, and Longchamp and Pusey, whom I have loaded with honors and riches. Philip of France, too, who swore when he left Palestine that he would be my friend. They must know that the Duke of Austria is keeping me a prisoner against all the laws of God and man merely to obtain money. But will they give a penny to ransom me? Not they! They have got hold of my kingdom, and they mean to keep it, and they will let me die here like a rat in a hole."

For several minutes he looked moodily out of the narrow slit in the huge walls that served him as a window. Then on a sudden he laughed aloud, and said: "Let me try my hand at the gay science again!"

He walked up and down his prison-cell, turning over phrases and fitting in rhymes, and at last he took up his lute and began to sing softly to himself these lines, which are still remembered as King Richard's:

Know, men of England, Anjou, and Touraine,
And all my knights with noble hearts and brave,
Your friendship, love, and duty now are vain
To free me from the bondage of a slave.

Remote from consolation here I lie,
The wretched captive of a powerful foe,
And here in grief I languish till I die—
Die, and am buried where no man shall know!



The Castle of Durenstein, where King Richard was imprisoned, as it appears to-day.

"That's a very good beginning," said Richard, recovering his gaiety. "I've learned a good deal about verse-making this year. If ever I should meet Blondel I do not think he will excel me again. Poor Blondel! I wonder what he is doing. Making love-songs for the fair ladies in Picardy, perhaps, but probably forgetting that he had ever a friend called Richard."

A fit of sadness again overcame the imprisoned king, and he went to the narrow window slit and stared sorrowfully at the open country.

Suddenly he reeled back as though he had been struck.

Someone was singing below, someone he knew, and the sweet voice pierced his heart. Nearer and nearer it came as the singer, clambering round the outer wall of the castle, gradually approached the narrow window of his room, where the king listened like a man in a dream.

The words of the song came clear and ringing on the evening air.

If you were housed in a hut in the vale,
And I were lodged on a hill on high,
Would you sing to me as the nightingale
Sings from a bush to a star in the sky?

It was the first verse of a song which Richard and Blondel had composed together many years before. None but these two knew of it, and Blondel was singing it to help him to find his king. He had sung it outside hundreds of castles, in the hope that the king would hear him and would sing back the second verse.

And now, when the minstrel had given up all hope, and was sitting beneath the castle wall, his eyes wet with tears, someone from a window above began to sing in a strong voice that shook with emotion:

If I were housed on a hill on high,
And you were lodged in a lowland pass,
I would sing to you as a lark in the sky
Sings to his love in her nest in the grass.

It was the second verse of the song which only the king knew! After all his efforts Blondel had at last found his king. Here in this castle he was imprisoned.

Leaping up with joy at his discovery, the minstrel sang the first verse again, to let the king know that he was still there listening. Then, careless whether he got a lodging for the night or not, he left Durenstein, and hastened through the darkness along the path which led for hundreds of miles across Europe to the English Channel. At night he slept on the rocky ground and shivered in his rags. By day, stopping only to gather such roots and wild fruits as would stay his hunger, he pushed on and on through the forest.

In the dark prison at Durenstein, Richard's hopes beat high. Blondel realized that, and his courage never flagged.

It was months before he reached England, but when he arrived there he sought out William Longchamp, the Lord Chancellor, who was still faithful to Richard, and in 1194 Richard of the Lion's Heart landed at the little English port of Sandwich a free man, through the efforts of Blondel.

THE KING'S THREE QUESTIONS

FREDERICK II, known as "the Great," king of Prussia, throughout his reign took the greatest interest in the improvement of the Prussian army. For the guidance of his generals he wrote a number of works covering the whole science of war, and he was very fond of his guards, and knew every one of the men personally.

Whenever he saw a new recruit he used to call him from the ranks and ask him three questions: "How old are you? How long have you been in my service? Are you satisfied with your pay and treatment?"

Sooner or later, after a man joined the regiment, he was sure to be spoken to by the king. Old soldiers made a practice of teaching new recruits how to behave when noticed by the monarch. The new men were always nervous until the ordeal was over.

One day a young Frenchman joined the regiment, and as he did not know any German, he was taught the answers to the king's three questions in the order in which they had always had to be given.

Not long after, Frederick caught sight of the young man but, unfortunately, on this occasion he did not ask the questions in their usual order.

"How long have you been in my service?" asked the king.

"Twenty-one years," replied the Frenchman.

"Twenty-one years!" said the king. "Then you must be very much older than you look. How old are you?"

"One year," answered the soldier.

"Upon my word," cried Frederick, "one or other of us must be mad."

"Both," said the soldier, who had been taught that this was the proper answer to give to the king's third question.

The king, of course, flew into a great rage, and the poor recruit then explained the whole matter in French, a language that the king understood perfectly. Frederick laughed heartily and advised the soldier in future to speak only a language he knew.

THE NEXT STORIES ARE ON PAGE 6029.

"Maintain the Law."

THE ROYAL CANADIAN MOUNTED POLICE

THE Royal Canadian Mounted Police—the only police force in the world who wear scarlet uniforms—began a little over fifty years ago. The great prairies of British North America for centuries had been inhabited by Indian tribes who lived upon the buffalo, and were prosperous and powerful; the British fur companies kept liquor away from them, and agreed with them comfortably.

But from 1870 onward a series of great changes befell the land, most of them misfortunes to the Indians. First of all, American whisky-traders, pushing up from the United States to the south, began to move through the country, and their influence threatened to ruin the Indians altogether. Then, in the strangest manner, the buffalo died out, and the Indians were left destitute. Almost at the same time white men came in to possess the land, first as ranchers with thousands upon thousands of cattle which the Indians longed to eat in place of the buffalo; then as engineers and navvies building a great railway through the prairies; then as farmers, and lastly as dwellers in towns and cities.

Every one of these changes was terribly hard upon the Indians. Yet there was no warfare between them and the whites, and to-day they are living peacefully in the country. Why was there so little trouble? Because the Canadian Government treated the Indians, on the whole, justly, and because the policy of the Government was enforced by the Mounted Police.

The Dominion of Canada acquired possession of the Northwest Territories in 1869, and in a year or two it found that the work of the whisky-traders among the western Indians was so dangerous that unless these pests were driven out, there would be so much warfare that settlement or proper trade by white men would be impossible.

The Northwest Mounted Police were raised, and in 1874 they marched across the prairies to the Rocky Mountains. It happened that about twenty-five years earlier a regiment of British infantry had been stationed for a while in the Red River settlement (now Manitoba), and the Indians not only had liked them, but also had associated the red coat with British soldiers.

A "Mountie" ready for parade.

They also were aware that their fellow Indians in the United States had had repeated quarrels with the Americans, whose soldiers wore blue. For this reason the Mounted Police were uniformed in red, and at the first glance the Indians recognized them as a British force. The whisky-traders were promptly driven away, and the Police at once made the Indians see that where they executed the law justice would be done.

The Blackfeet were a very powerful tribe in what now is southern Alberta. One of their leading chiefs, Crowfoot, after seeing two of his men tried for an offense with which they had been charged, said: "This is a place where the forked tongue is made straight; when my people do wrong they shall come here." The Police became such good friends with the Indians, while making them strictly obey the law, that in 1877, three years after their arrival in the country, when it was proposed to conclude a treaty by which the Indians would agree to settlement by the whites, the Indians consented. Chief Crowfoot in his speech said: "The Police have protected us as the feathers of a bird protect it from the frosts of winter."

Soon afterward the great calamity of the disappearance of the buffalo befell the Indians, but the Government gave them help, and the Mounted Police kept them from doing what starving savages would do naturally—go raiding against people who had food. As white settlers came in the Police made them obey the laws, and the Canadian Northwest always was orderly.

THE YUKON TERRITORY DURING THE GOLD FEVER

In 1898 gold was discovered in the Yukon Territory, and great numbers of people rushed to the diggings. With the genuine miners went crowds of gamblers, thieves and other bad characters to prey upon the men who did the work; and in the American towns through which the gold-seekers passed, like Skagway, vice, crime and disorder were uncontrolled. But Mounted Police had been stationed in the Yukon before the great gold discoveries were made, and from the beginning of the rush they kept order, so that

The R. C. M. P. winter headdress.

Travel on the Dease River in northern British Columbia: towing a boat through the shallows.

Dawson and the other towns in the mining region always were quiet, law-abiding and safe. When a man was found carrying a revolver in Dawson he got a month "on the wood-pile" without the option of a fine; so that the second-hand stores were full of weapons, and pistols were the only things cheap in Dawson.

The trails, and the creeks where the gold was found, were watched, and the prospectors and miners were protected. Every boat on the river was numbered, so that missing parties could be traced. A few men were murdered on the long and lonely trails, but in each case the Mounted Police followed every clue and in the end captured the slayers. One murderer was traced from the Yukon, through the United States, to Mexico, and was brought back by way of Jamaica and Halifax. So far as is known, no murder occurred in the Yukon without the perpetrator's being discovered, arrested and convicted.

THE MOUNTED POLICE HAVE MANY DUTIES IN THE YUKON

In addition to enforcing obedience to the law, the Mounted Police have performed an immense number of other duties. To this day in the Yukon they discharge nearly all the functions of government, from enforcing town by-laws to acting as postmasters and customs officers. One curious piece of work has become noticeable of late. Many prospectors have been in the country since the first discoveries of gold, nearly thirty years ago, and have become old and feeble. In the winter the Police send patrols through the wilds to see that these men, as well

A constable on a patrol in northern British Columbia, near the headquarters of the Liard River. Traveling is done in summer with pack dogs.

as the scattered trappers, are safe. This sort of duty is familiar to the Mounted Police, for when the prairies were filling up with farmers it was necessary to protect scattered settlers from the dangers of winter, and after a series of blizzards fur-clad horsemen would make long patrols to see that lonely families had sufficient food and fuel and were not suffering from illness. To-day the country where this was done has nearly a million and a half of inhabitants and is one of the greatest grain-growing districts in the world.

THE MOUNTED POLICE AFTER 1920 NO LONGER RURAL CONSTABULARY

A great change came in 1920 whereby the Force was made an all-Canadian one. In the beginning it was called the Northwest Mounted Police and had charge of the police work in what was called then the Northwest Territories—the region which lay between Manitoba in the east and British Columbia in the west, and north of the 49th parallel, the boundary between Canada and the United States: the region now occupied by the provinces of Alberta and Saskatchewan.

In 1905 the work done there and in the Yukon was recognized by an honor greatly prized by British soldiers: they were given by the king the title of "Royal," and for the next fifteen years they were the Royal Northwest Mounted Police. As the years went on their duties changed. At first they had been a police of the wilderness, keeping Indians from fighting each other and bad white men and Indians from stealing horses and cattle; then as villages and towns sprang up and farmers began to grow grain they had to "maintain the law" (the motto of the corps) in town and countryside.

As towns like Calgary, Edmonton, Regina and Saskatoon grew larger they set up their own police forces, the Mounted Police thus remaining long, on the whole, a rural constabulary, dealing with the sort of crimes that are to be found in country districts, and in the Yukon, of course, with a mining and trading community. Then about 1905 they began to pay attention to the Arctic regions, as it became known that whalers were visiting them and injuring the Eskimos, even as the whisky-traders had corrupted the Indians in 1870. There were posts on the Mackenzie River and at Herschel Island by 1903.

THE ROYAL CANADIAN MOUNTED POLICE ENFORCE THE FEDERAL LAW

The World War brought other changes. After a period during which the Force was kept in western Canada to insure order, it was allowed to furnish troops for the front, and two squadrons of Mounted Police went overseas, one to France and one to Siberia. This meant giving up the rural police work which had been done so long, and the new provinces of Alberta and Saskatchewan took over their own policing and formed provincial forces of their own. Further than that, the Dominion authorities had been feeling more and more, for a long time, that they needed police of their own in all parts of the country for a great many different duties. All this time they had been maintaining two police forces, for, besides the Royal Northwest Mounted Police in western Canada, they had in eastern Canada the Dominion Police, nearly all of whom were in Ottawa, where they guarded Government buildings, tracked down counterfeiters, managed a Criminal Identification Bureau, and performed certain other duties. In 1919 it was decided that the Royal Northwest Mounted Police should absorb the Dominion Police and, under the name of the Royal Canadian Mounted Police, should do the police work needed by the Dominion Government all over the country. The new system came into existence very early in 1920.

MAINTAINING THE LAW IN VARIOUS INSTANCES

The Mounted Police thus are not a rural constabulary, as they were before the World War; in all the provinces of Canada, Saskatchewan and Alberta as well as the others, ordinary crimes are detected and punished by the provincial governments. But there are some crimes which offend the Dominion Government rather than those of the provinces. Counterfeiting is one, for all that pertains to currency is a federal matter; making liquor in private stills is another, because it breaks the Excise Act; smuggling is another, for customs are the concern of the Ottawa Government; and so forth. Against offenses of this sort the Mounted Police now must take action.

Again, there now are a great many laws which require inspection and enforcement. To take one instance, by the Explosives Act people who keep gunpowder, dyna-

LOOKED AFTER BY THE R. C. M. P.

On the Peegan Reserve, where the Police guard the Indians. Here they still live in wigwams during the summer months. The Peegans belong to the tribe and confederacy of the Blackfoots, which are of Algonquin stock. The name is explained as an allusion to their leggings, which the whites noted to be blackened by their march over the newly burned prairie. A hundred years ago the Blackfoots formed one of the strongest confederacies of the northwest.

A group of Indian children belonging to the Peegan tribe, which lives on the Peegan Reserve near Macleod.

mite and similar explosives for sale or use must store them carefully, and it is necessary to visit them to see that they obey the regulations. To take another instance, fishermen must refrain from catching fish, oysters, lobsters, and the like in certain seasons and of a certain size, and for their own good careless or greedy ones must be watched and made to obey. To take yet another example, airplanes which fly over Canadian soil must observe certain conditions, and here again it is necessary to have someone to enforce compliance.

The list of things of this sort is very long, and all over Canada detachments of the Royal Canadian Mounted Police are "maintaining the law" by catching smugglers, detecting counterfeiters, discovering and arresting people who sell narcotic drugs, ferreting out illicit stills, protecting migratory birds, and doing a thousand other things, sometimes difficult and tiresome, sometimes interesting. They still keep in close touch with the Indians, with whom their relations nearly always are exceedingly friendly; they still do an immense amount of work in the Yukon; and they also have a new field of adventure in the Arctic, where new posts are being opened every year, and a larger and even larger proportion of the Force is stationed.

"Big Alec," an Indian living on the Liard River, cooking. This man was charged with having instigated the murder of a youth for witchcraft. He also killed four of his own dogs, as he thought that they had bewitched him.

THE POLICE HAVE DIFFERENT FUNCTIONS ACCORDING TO REGION

Thus the Royal Canadian Mounted Police are not quite like other police forces. They deal with the ordinary sorts of law-breaking—thefts, murders and so on—only in the wilder parts of the country, and in the civilized regions they are more like agents of the Government. They are soldiers, for the recruit gets a military training and is taught to ride and shoot and, above all, to obey orders.

It is common knowledge that the Force is highly regarded. People outside as well as inside of Canada feel that it discharges its duties honestly, fearlessly, impartially; that its men are courteous as well as inflexible, doing their duty without being rude or overbearing; that it is greatly feared by evildoers, who know that they will be followed patiently and unrelentingly, so that a legend—which is only a legend—has sprung up that its motto is: "Get your man." All these qualities rest upon discipline—the strict but sympathetic discipline of the British Army, which succeeds in uniting obedience and mutual consideration, so that all ranks are permeated with the sentiment of honor.

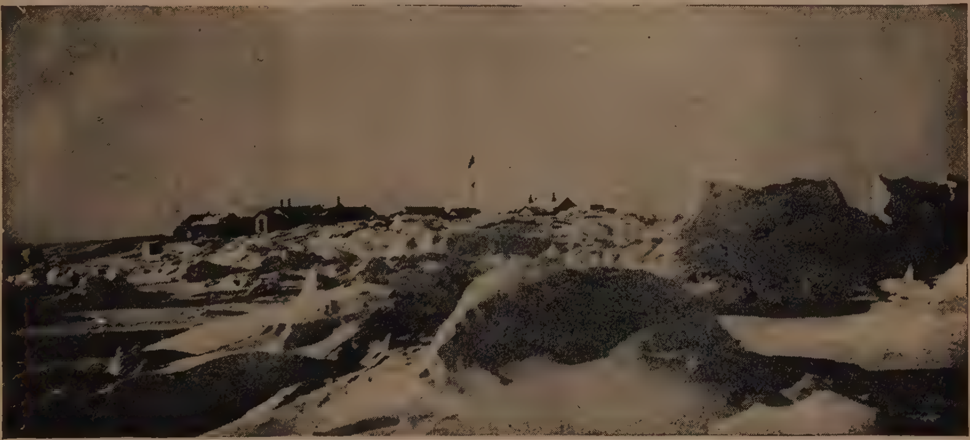
To a great extent it is a rather young force, for most of the recruits are youths, and as the term of enlistment is three years, with re-enlistment for one-year or three-year terms, many leave after a comparatively short service. Indeed, one notable feature of the Force is that it is greatly favored by young Englishmen—often of good education and social position—who by serving a term or two get accustomed to what to them is a new country. Young Canadians, too, often join as a means of starting in life, and among them also the average of education and cultivation is high. One effect of this peculiarity is that there are many men in good position all over the country who in their day wore the "scarlet and gold," and the more sober brown jacket used for patrolling jacket. If, however, a man is suited to the work and chooses to remain, there is a life-work, the chance of promotion, and a pension at the close of service. Most of the commissioned officers began in the ranks.

THE WHITE ROMANCE OF THE FORCE TO-DAY

There is still romance in the Force. To-day it is a "white romance," in the Arctic snows. Canada is asserting her control of the regions of the North, and year by year her servants, the Police,

THE "MOUNTIES'" NORTHERN FIELD

Eskimos near Fort Churchill, where the winter is extremely severe. They, however, know how to dress and feed and live so as to lessen its severity.



Looking up from the river across the ice wastes, one can see the Fort Churchill barracks of the Royal Canadian Mounted Police.

Exterior of Fort Churchill. The tent-like object in the rear is a pile of firewood. In the centre are Mounted Police and their team of huskies. A baby Eskimo may be seen on the left.

Photos, courtesy Royal Canadian Mounted Police.

move nearer and nearer to the Pole. As everybody knows, a lane of water leads from the Atlantic to the frozen ocean at the top of the world. To the east of it is Greenland, to the west a string of islands, the Canadian Arctic Archipelago. On each of the easternmost of these islands, on Baffin Island, North Devon Island and Ellesmere Island, Royal Canadian Mounted Police detachments are established, the officer or non-commissioned officer in charge being postmaster, customs officer, coroner, justice of the peace, and, in short, the general representative of Government and settled administration.

At present the Force has a sub-post near Cape Sabine, about the middle of Ellesmere Island, the last land before the Pole; when they get to its northern end they will be only four hundred miles from that goal of adventurous exploration. Farther west there are posts on Coronation Gulf; patrols are regularly made in Victoria Island; and Hudson Bay and the Mackenzie River are completely under control.

All this means arduous journeyings, usually in winter, sometimes in weather so cold that the sledge dogs bleed from the mouth, and covering so much ground that a patrol is hardly counted unless it covers some hundred miles. The officer commanding one of these sub-districts usually travels from two to five thousand miles in a year—by ship, river steamer, motor boat, canoe, dog sled and snowshoes. Often distress is succored, and sometimes crime is detected and punished, for it has been discovered that the natives have a bloodthirsty side also. In the last ten years more than twenty murders by Eskimos have come to light.

THE COURTS HELD FOR THE ESKIMO

Three times Canadian courts have been sent long distances to the Arctic, and judge, jury and prosecuting and defending counsel have tried Eskimos for capital offenses. In each case the Mounted Police had learned of the crime, had ascertained the particulars, arrested the accused, collected the witnesses, held the preliminary hearings and prepared the cases. Each Eskimo prisoner had as fair and careful a trial as any man under accusation in any part of Canada. In one instance the whole case rested upon one non-commissioned officer. As policeman, he investigated the rumors he heard and found the body of the murdered man; as coroner, he held an inquest; as justice of the peace, he held the preliminary hearing and committed the accused for trial; as policeman, he got the witnesses together for the trial; as registrar of births, marriages and deaths, he furnished a death certificate to account for the absence of a deceased witness. Not a document was lacking, and the trial was as carefully conducted as if the murder had taken place in a large city.

The northernmost of these detachments is at Craig Harbor, in Ellesmere Island. It is a post office, the farthest north in the world. Every year a number of children write letters addressed to "Santa Claus, North Pole" and post the letters. The nearest post office being Craig Harbor, the letters are faithfully sent there; and they are as faithfully answered. Santa Claus's address now is "Care of the R. C. M. Police, North Pole." Every year as soon as the ice is open the Canadian Government sends a supply ship north.

YORK FACTORY, HUDSON'S BAY COMPANY'S POST

WHERE DOES A THOUGHT COME FROM?

THIS is the question of questions. We know certainly that thoughts depend on the brain. If we are to do our duty to ourselves, we must regard the brain as the place where the real self lives. We must not poison it with alcohol, we must not abuse it by depriving it of sleep, and we should even think of every one of the other parts of our body as no more than its servants. The brain is the house of thought, but it is not thought itself; and though there is no harm in saying for convenience that the brain thinks, that will not really do as an answer to our question.

There is a something that thinks, a something that knows. We cannot feel it, or see it, or cut it up; for it lies underneath all that we can see and cut up. The word substance means a "standing underneath." And so when you ask where the thoughts come from, we can only reply that they come from the thinking substance—the something that thinks.

When you ask where thoughts go in sleep, it is, perhaps, as if you had asked, Where does the music go when the violin or the organ is not being played on? When we are asleep the brain—or, rather, the highest part of the brain—is not acting. It remains alive, of course, and has the needs of a living thing. It requires pure blood, which is one reason why we should sleep in pure air, but it is resting as a fiddle rests in its case; so no thought comes from it.

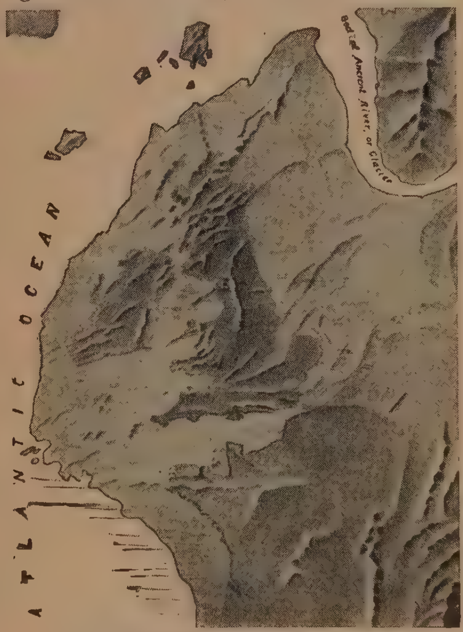
We are never wholly asleep, however; part of our bodies is always working, and even part of the brain. Sometimes we can be sure that, though the self we know is asleep, part of the self we do not know so well is not asleep, for men have awakened with the answer to questions which they could not answer the night before. Many cases like this show that sometimes a certain amount of thinking goes on in our brains even when we are asleep—or when, at any rate, the greater part of us is asleep.

We think because it is our nature to think, and this it is which distinguishes us from all other creatures.

We should always make a point of using the word thought in the strict way to mean the putting together of two ideas. "Tom is good" is a thought. It puts together the idea of Tom and the idea of goodness. We say that there is a relation between Tom and the state of goodness. "Tom is not good" is another thought, asserting another kind of relation between Tom and goodness. Many people do not always understand clearly what the words "thought" and "thinking" mean.

COULD A MAN EVER WALK FROM FRANCE TO ENGLAND?

Yes, for in past ages England and France were joined by land. It was only the invasion of the sea, due to some disturbance, that made Britain an island cut off from the mainland of Europe. The Straits of Dover are so shallow, even today, that if St. Paul's Cathedral were sunk in them the dome would be seen above the water in the deepest part. The North Sea and the English Channel are not very deep, and, as can be seen by the map on this page, Europe once jutted out much farther into the Atlantic than it does now.



How England was joined to France.

Scotland and Norway were also joined together at one time, the estuary of a big river or a massive glacier being where the Cattegat now is. The seas immediately round Britain are so shallow that a very slight fall in the sea-level would suffice to join Britain once more to the Continent. On the other hand, a slight rise of the sea would flood southeastern England and the Flemish plain, and put a wide sea between Britain and the mainland. Geologists tell us that at different times in the past both these conditions have occurred.

There is no doubt that when the British Islands were joined to Europe men and animals passed freely over them from other parts of the Continent. But Britain has far fewer animal species than the Continent, and this is explained by the famous English naturalist Dr. Alfred Russel Wallace, who believes that the greater part of the British Isles was submerged during the Glacial period.

WHAT POWER KEEPS A KITE FLOATING IN THE AIR?

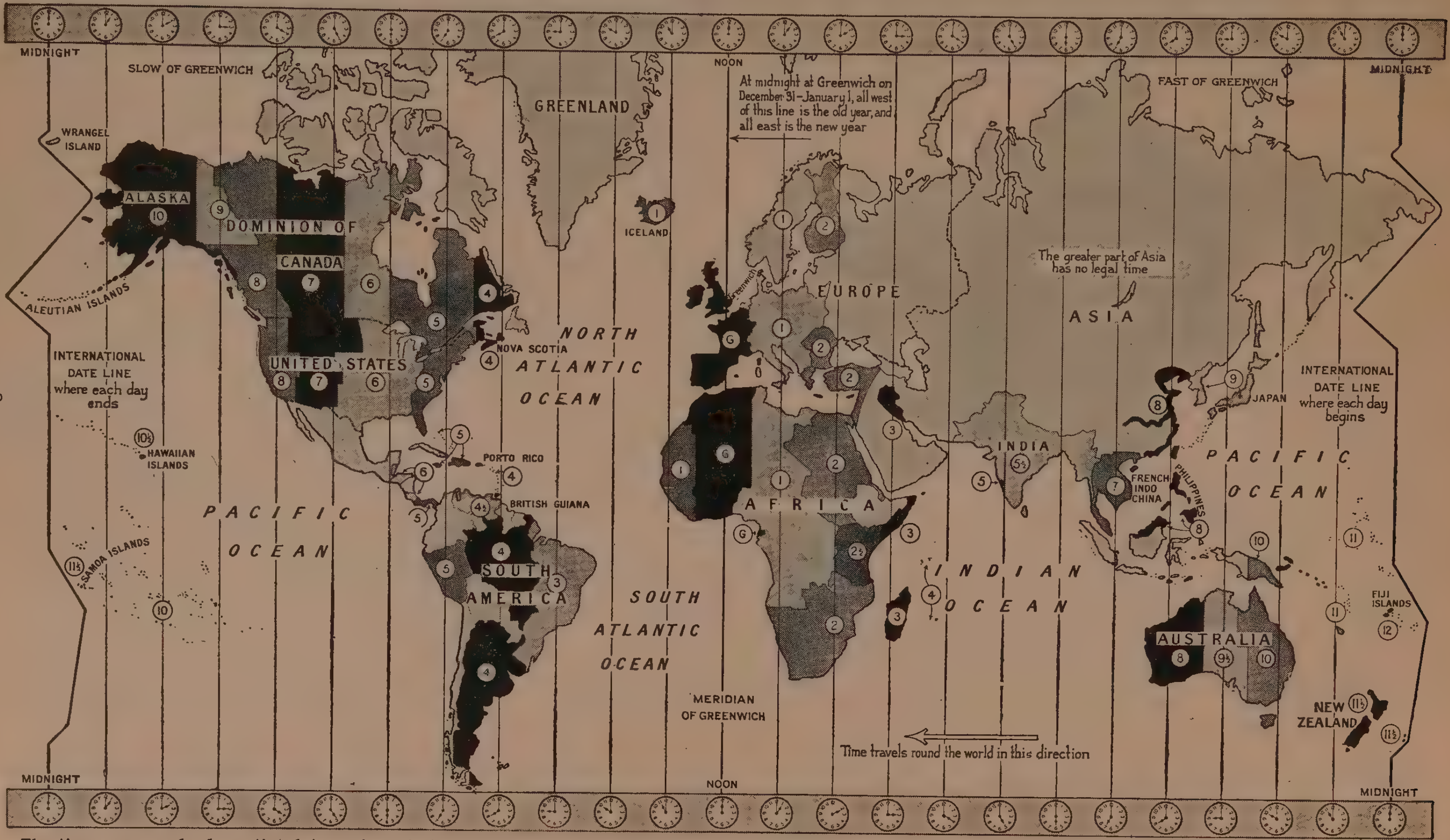
The case of the kite proves to us that the air has a great power of holding things up. The kite has no wings and yet does not fall. The air supports it. If we took all the stuff of which a kite is made and rolled it into a tight ball, it would drop like a stone. Thus, it is not that the kite is made of something lighter than air. The reason why it flies is that it is spread out as wide as can possibly be, so that it has a large surface for the air to support it. Of course, if there were no air at all, the kite would drop at once, as the bird would, whether it were flying or not. Neither the kite nor the bird could rise or swim in nothing. The Latin word meaning empty is *vacuus*, and a place that is quite empty is called a *vacuum*. Nothing can soar in a vacuum.

But the kite flies, not only because it presents a large surface to the air, but also because it is slanted to the wind in such a way that the wind pressure forces it to rise. If the wind pressure be not strong enough, we run and pull the surface against the wind, and by increasing the pressure raise the kite.

AMONG THE MILLIONS OF STARS ARE THERE WORLDS LIKE OURS?

A world like our own stands alone. All the planets that we know and can see are so unlike it that they could not support life as we know it, and we cannot imagine any kind of life as existing on any star. But even as our own particular star, the sun, has a number of cooling or cold spheres about it, so we suppose that a great majority of the millions of stars that can be discerned through the great telescopes are similarly attended. There must be therefore hundreds of millions of dark spheres, or planets (or worlds, as we call them) which cannot be seen, and so far as we know may never be seen. There are so many of them that some must be like our own, though we have no means of proving it. It is a fascinating idea, but we cannot imagine a telescope that can bring a star so close that we may examine its planets.

TIME MAP OF THE WORLD, SHOWING THE DATE LINE AND TIME ZONES


MIDNIGHT
SLOW OF GREENWICH
NOON
FAST OF GREENWICH
MIDNIGHT
WRANGEL ISLAND
ALASKA
10
9
DOMINION OF CANADA
8
7
6
5
4
GREENLAND
ICELAND
1
At midnight at Greenwich on December 31–January 1, all west of this line is the old year, and all east is the new year
ALEUTIAN ISLANDS
INTERNATIONAL DATE LINE where each day ends
UNITED STATES
8
7
6
5
NOVA SCOTIA
4
NORTH ATLANTIC OCEAN
10½
HAWAIIAN ISLANDS
PORTO RICO
4
5
6
BRITISH GUIANA
4½
5
PACIFIC OCEAN
11½
SAMOA ISLANDS
10
SOUTH AMERICA
4
5
3
4
SOUTH ATLANTIC OCEAN
MERIDIAN OF GREENWICH
Greenwich
G
1
EUROPE
2
AFRICA
G
1
2
3
2½
3
4
INDIAN OCEAN
ASIA
The greater part of Asia has no legal time
INDIA
5½
5
FRENCH INDO CHINA
7
8
PHILIPPINES
8
9
JAPAN
PACIFIC OCEAN
10
INTERNATIONAL DATE LINE where each day begins
11
11
FIJI ISLANDS
12
AUSTRALIA
8
9½
10
NEW ZEALAND
11½
11½
Time travels round the world in this direction
MIDNIGHT
NOON
MIDNIGHT

The time zones on land are tinted in various shades; areas with the lightest tint have no standard time. The figures west and east of Greenwich show hours slow or fast of Greenwich time. See page 5845.

WHO FIRST THOUGHT OF STANDARD TIME?

This is a question which cannot be answered. Some men must have thought of the idea without understanding how to work it out. However, the first man who tried to make the idea work was a distinguished Canadian engineer, Sir Sandford Fleming. In 1879 he published a proposal to divide the earth into time zones. The railway men of the United States and Canada accepted the idea before other countries, and zones were laid off. In the first, which includes the most eastern part of Canada, there is Colonial or Atlantic time, four hours slower than Greenwich time. Next we have four zones which are the same in both countries. They are Eastern, Central, Mountain and Pacific, and the time in each is an hour slower than in the one before. Later the Yukon zone was laid off in Canada and the Alaska zone in the United States. Alaska time is two hours slower than Pacific time, and five hours slower than Eastern time. Do you know in which time zone your home lies, and where the watches are changed for the next zone?

WHAT MAKES THE POISON IN A SNAKE'S FANG?

A snake's fang is an eye-tooth, or canine tooth, as it is called, corresponding to the sharp-pointed teeth that we have at the corners of the jaw between the front teeth and the back teeth. In the case of the poisonous snakes the tooth has a special channel in it through which the poison can run when the snake bites. The snake has certain glands like the salivary glands which in man produce saliva and assist in the mastication and digestion of food.

In the snake, however, these glands do much more than that, and especially the gland which corresponds to the one we have in front of the ear, the one which gets so big and painful when we have mumps. In the snake the business of this gland is to produce the poison. It runs along a little tube from the glands on each side of the mouth to the poison teeth. When the snake bites, the muscles of the jaw, which make the teeth meet, also squeeze upon the glands in these tubes in such a way that a little of the poison is forced through the channel in the fang, and left in the victim's body.

The amount of poison thus injected is, as a rule, exceedingly tiny, but the venom, or poison, of many of the venomous snakes is among the most deadly of all poisons, and a mere portion of a drop will kill. This is a deeply interesting question from the widest point of view, because it is so remarkable to discover that, in certain kinds of animals, parts of the body which are possessed by so many other kinds of animals, and which serve one purpose in the first place, are turned to a quite new and special purpose in these particular cases. In non-poisonous snakes, these same glands, which are so poisonous in the venomous snake, look just the same, yet produce nothing to hurt anyone.

WHY DO WE NOT SEE OUR BREATH ON A WARM DAY?

We know that our breath is warmer than the air outside; but though the breath coming out of our bodies is always of very much the same temperature, the air outside varies very much. Sometimes the air outside is so warm that it does nothing in particular to that gaseous water—or water in the form of a gas—which is always in our breath; and so we see nothing.

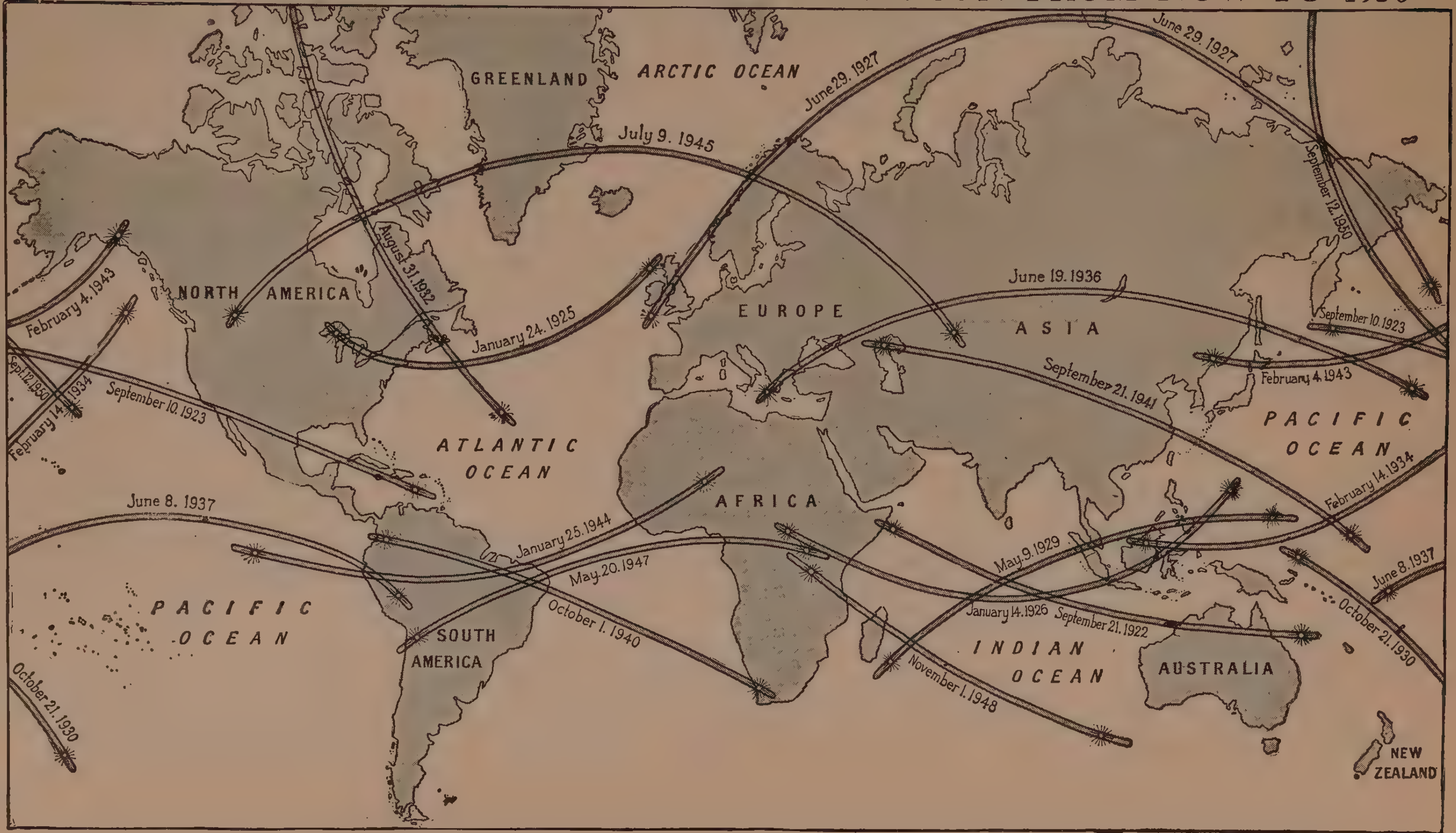
But on a cold day this gaseous water, as it leaves our bodies, is suddenly turned so cold that it forms a little cloud, made, like other clouds, of drops of water. That is what we see when we say that we see our breath. It is the water in our breath that has been turned liquid by the cold. There is just as much water in our breath on a warm day, but then it remains in the form of a gas as it comes from our bodies. But if we take a piece of cold glass, even on a warm day, and breathe on it, we get a little cloud of water forming on the glass, and that is "seeing breath."

WHY MUST A DIVER HAVE LEAD ON HIS BOOTS?

The diver would certainly sink without the lead on his boots. His body itself is slightly heavier than water, and though the small quantity of air between himself and his case tends to make him float, yet the metal round his head makes him heavier still.

The point about the lead on his boots is that it makes him sink faster and in the right direction. If it were not for that he might sink head first or sideways, and might find it exceedingly difficult or impossible to right himself. The lead serves, in a way, the same purpose as a piece of lead placed at the bottom of those little

THE PATHS OF ALL THE ECLIPSES OF THE SUN FROM NOW TO 1950


GREENLAND
ARCTIC OCEAN
NORTH AMERICA
EUROPE
ASIA
ATLANTIC OCEAN
AFRICA
PACIFIC OCEAN
PACIFIC OCEAN
SOUTH AMERICA
INDIAN OCEAN
AUSTRALIA
NEW ZEALAND
June 29. 1927
June 29. 1927
July 9. 1945
August 31. 1932
February 4. 1943
January 24. 1925
Sept. 12. 1950
February 14. 1934
September 10. 1923
June 19. 1936
September 12. 1950
September 10. 1923
February 4. 1943
September 21. 1941
February 14. 1934
June 8. 1937
January 25. 1944
May 20. 1947
October 1. 1940
May 9. 1929
January 14. 1926
September 21. 1922
June 8. 1937
October 21. 1930
November 1. 1948
October 21. 1930

THIS MAP OF THE WORLD SHOWS THE PATHS ACROSS WHICH THE SHADOW CREEPS IN ALL THE TOTAL ECLIPSES OF THE SUN FROM NOW TO 1950.

See page 5844.

toys which cannot be upset. A closer parallel is the case of the balloon, which is kept the right way up by having its heaviest part below.

WHY IS THE SURFACE OF WATER ALWAYS LEVEL?

Water, like everything else, is under the influence of gravitation. All the parts of it must therefore get as near as possible to the centre of the earth. In the case of a solid thing, those forces which hold it together partly oppose the force of gravitation, and so a rubber ball, for instance, will remain as a ball, though if it were melted it would run flat out on the table as water would. But when we come to consider what the shape of the earth is, we shall see that our question is not quite right if we are to read it strictly. The earth is a ball, and if water is to obey the law of gravitation and get as near the centre of the earth as possible, it follows that the surface of water must always curve, and its curvature, as we say, must be the same as the curvature of the earth. The water in the smallest pool or basin must obey this law, but, of course, the curve is so slight that we cannot see it.

If, however, instead of a pool we take a huge lake or the ocean, we can see for ourselves that the surface of the water is curved, because we can see how a ship leaving us gradually disappears, or a ship coming over the horizon rises up as it approaches us. So the real answer to this question is that the surface of water is *always* curved; and it is always curved in one way—the way in which the earth itself is curved.

HOW CAN WE FORETELL AN ECLIPSE OF THE SUN?

We can predict the movements of the heavens because they move to order, and we can time the progress of the planets as we time our movements by the help of a watch.

While the earth goes round the sun, the moon goes round the earth, and at certain times the moon comes between the earth and the sun during daytime on one hemisphere, and cuts off the sunlight from certain places on that hemisphere as it passes along.

Twelve or thirteen times in the year the moon is, in a way, between the sun and earth, but not directly between, and not always in such a position as to cause an eclipse; for the earth goes round the sun in one plane and the moon round the earth in another plane, and unless the planes intersect or nearly intersect, the shadow of the moon does not fall on the earth. We must have earth, sun and moon almost in a straight line, with the moon in the centre, before we can have an eclipse of the sun.

The periods at which sun, moon and earth are so placed can be found out by astronomical calculations, and thousands of years ago the Chaldæan astronomers discovered that eclipses recur at intervals of 18 years and 10 or 11 days. If, then, we note the exact time of the middle of any eclipse and count forward 18 years and 10 or 11 days, we shall find another eclipse of exactly the same kind, though generally not visible at the same place. This period of 18 years 10 or 11 days was called by the Greeks "the saros," and the name is still used.

As an example of the saros we may notice that a total eclipse was seen in Europe on July 8, 1842, and seen again in America and Spain on July 18, 1860, and seen again in Colorado and on the Pacific coast on July 29, 1878, and on our eclipse map herewith it is seen to be expected punctually again in North America on August 31, 1932. It will be noticed, too, that on the map we find the interval of 18 years constantly illustrated.

IS A FLY STRONGER THAN A MAN, COMPARING THEIR SIZE?

What the question really means is this: "Is a fly really stronger than a man relatively to its size, or in proportion to its size?" The answer is certainly yes. The last thing in the world that distinguishes man is bodily strength of the kind which is shown in lifting weights, and so forth. It is by *skill*, made not by the muscles but by the brain, that man lives on the earth—skill, not strength. If we weigh the proportion of the bodies of different animals that is made of muscle, and if also we weigh the proportion that is made of brain, then we learn how muscle has been getting less and less important, while brain has been getting more important.

Not only a fly, but animals in general are the superiors of man so far as muscular strength is concerned; but then the question of muscular strength is an inferior one, and man is master because of what really matters, which is mind. The race is not to the swift, nor the battle to the strong, but to the wise, who use their brains to good advantage.

WHY DOES IRON FLOAT ON MERCURY AND NOT ON WATER?

All questions of floating and swimming and flying depend on the comparative differences between various things as regards gravitation. Iron is heavier than water, or, as we say, its specific gravity is greater than that of water. Iron must therefore sink in water. Mercury is heavier than water, and therefore mercury must sink in water. But mercury is heavier than iron, and it must therefore sink in iron, which is just a peculiar way of saying that the iron must float on the mercury. The thing with the highest specific gravity is the thing for which the earth has the strongest pull. It therefore gets nearest to the earth, and anything else must float on the top of it.

WHERE DOES THE DAY BEGIN?

The sun is always seeming to rise somewhere, because at some place or other the earth is just spinning round so as to face it, and the sun is always seeming to set somewhere, because at some place or other the earth is just spinning away from the sun.

And, of course, whatever we call *now*, whether we call it six o'clock or twelve o'clock, *this now is now everywhere*. The present moment *is* the present moment here and on the farthest star. Only when just opposite the sun *we* call that midday, whereas the people on the other side of the world are then away from the sun, and call it midnight.

But, simply because the earth goes on spinning and the sun is always shining, the day is dawning somewhere always; and *really*, therefore, the answer to the question Where does the day begin? is that the day is always beginning somewhere or other.

Since people live in different parts of the world, what we call night (when it is our night) will be someone else's day, and our midnight, when a new day begins for us, as we reckon, will not be the midnight of other people in other parts of the world, so that what we *call* Monday they may *call* Tuesday, yet we and they are both talking about the same moment!

In order that we shall not get more mixed than we can help—and we cannot help getting rather mixed as we do not all live on the same line, and the earth *will* keep on turning!—we have agreed that we shall take a line exactly on the other side of the earth from the Greenwich line, and this we call the date line. When it is midnight on the date line, what is called Monday on one side of the line is Tuesday on the other side. Fortunately the date line scarcely touches any land at all, and the little it does touch is very unimportant land. The line passes across the ocean. It makes one or two deviations from the straight for the sake of convenience. The Aleutian Islands, for instance, are placed on the same side of the line as Alaska.

WHAT IS MEANT BY A TIME ZONE?

Every place in the world really has its own local time, which is different by minutes or hours from that of every place east and west of it. But when railways and telegraphs come it is convenient for a country to have a uniform system of time throughout all its territory, and thus throughout England, Scotland, Wales, Ireland, France and Spain Greenwich time is observed.

Not only so, but different countries that have constant dealings with one another find it extremely inconvenient to have differences of time that involve an odd number of minutes and seconds, and the chief countries have, therefore, agreed to form *time zones*, in each of which there shall be a standard time based on Greenwich, and varying from it only by hours and half-hours, and not by odd fractions.

The whole earth is divided into twenty-four equal zones of fifteen degrees each, corresponding with the twenty-four hours of the day, and at sea these are rigidly observed by ships. But on land the boundaries of the zones are irregular so as to include in the same zone certain areas closely connected for commercial purposes. For example, a city is never divided even if it is on the line. A glance at our time-zone map on page 5841 shows how irregular these land boundaries are. Some countries such as Canada, the United States and Brazil, are so large from east to west that they are divided into several time belts.

The convenience of this system of standard time zones is clear when we compare countries that have adopted it with those that have not. Thus Peru with zone time is exactly five hours slow of Greenwich, while its neighbor Ecuador, with the same longitude, is 5 hours 14 minutes 06.7 seconds slow of Greenwich.

HOW DOES THE MILK GET INTO THE COCONUT?

The stuff that we call the milk of coconuts is not milk, and has nothing about it at all like milk except its appearance. It would be a puzzle, indeed, if real milk were found in coconuts, for milk is formed only by the milk-glands of certain animals called mammals. If you tried to feed a baby on the milk of coconuts instead of real milk, you would very soon learn the great difference there may be between things that look the same. Only it would be a very wrong thing to do, for the baby would very soon die. Various plants besides the coconut produce fluids that look milky, and are often called milk because they look like it; but no plant produces anything like real milk. The milk of the coconut is a fluid formed by the tissue or substance of the nut, and so we need not ask how it gets there.

WHY DO LOBSTERS TURN RED IN BOILING?

The red color of a boiled lobster is simply due to a chemical change that occurs in the brown coloring matter of the shell when it is heated. It is curious that red coloring matter, such as the hemoglobin of our blood, turns brown when it is heated, but the brown of a lobster's shell turns red. If the lobster were red in the sea he would be too easily seen, and would not be able to catch his food unawares, so he would die of starvation.

ARE THERE PEOPLE ON THE MOON?

Well, we have seen only one side of the moon because, as it goes round the earth, it turns slowly on itself and always keeps the same side turned toward us. But we are quite sure that there are no people on the moon, either on this side of it or on the other side, which we have never seen. People could not live on the moon because its surface has no air or water. Even if people could live there without air or water, they would probably be burned to death in the daytime, as there is no air to protect them from the heat of the sun, and they would be frozen to death at night, with no air to keep in the sun's heat. There are certainly no people on the moon.

But possibly at one time there may have been humble forms of plant life on the moon, and some people suppose that there may be a little of this even now. It is just possible that there may be a very tiny amount of air and water still left at the bottom of some of the deepest valleys in the moon. If there was a building on the moon as big as some of ours, we should quite easily be able to see it through our biggest telescope, but there is not the slightest sign that intelligent beings have ever made a mark of any kind on the moon.

WHY IS THE FIRE HOT?

The heat that we feel when we stand opposite a fire is of two kinds. Partly it is the heat in the air which the fire has made warm, and which we feel against the skin. That heat has flowed into the air from the hot fire; but by far the greater part of the heat we feel opposite the fire is what is called radiant heat, a thing which is exactly of the same nature as light, only that instead of *seeing* it we *feel it hot.*

So our question is: What happens in the fire that makes it produce the heat that we feel? It is plain to us that when heat is being produced something is being done, something is being made, and we know that the power has to come from somewhere. It comes from the carbon in the coal and the oxygen in the air.

They have energy and power locked up in them which are released when the carbon and oxygen combine to make the fire. The energy of the carbon and oxygen are changed, when they combine, into heat energy. This heat shows itself in a rapid motion, we suppose, of the matter in the fire. This communicates itself to the atoms of the air, making them hot, and starts the waves in the ether.

WHY CANNOT WE WASH THE COLOR OUT OF SOAP?

We often notice that the color comes off things, and the reason, of course, is that the color is only on the surface, and if the surface is scraped or rubbed or worn away, the color goes with it. But many things are colored all the way through. We might say, Why does not the color come off a brass fender or off a silver spoon or off a gold ring? The color does not come off in these cases for the same reason that explains why it does not come off soap. The soap, like the fender or the silver spoon or the gold ring, is made throughout of colored material, and the color continues to show.

THE NEXT WONDER QUESTIONS ARE ON PAGE 5957.

Some of the beautiful buildings in the Kremlin at Moscow.

RUSSIA AS IT IS

RUSSIA reaches out to the Pacific Ocean on the east and to the Baltic on the west. On the north she looks over the Arctic seas. Southward her boundaries are the Caucasus, the highlands of Asia Minor and the Black Sea coast.

Russian territory was decreased as a result of the World War. Russian Poland passed into the new Poland; Bessarabia went to Rumania; Finland, Esthonia, Lithuania and Latvia became independent states. Yet in area she covers over eight million square miles and her population is 147 millions. That is to say, Russia is nearly twice as large as China, though she has only about a third as many inhabitants. She is two and a half times as large as the United States, with its population of 120 millions.

Among the reasons for the thinness of the population are the vast areas of northern Russia and northern Siberia, where the ground is frozen for long periods, and where close human settlement is impossible. There the great areas of virgin forest which make profitable hunting-ground for the hunter and the trapper, and provide much timber for Russia and for Western Europe, are useless for agriculture and industry. But the principal cause is that Russia remains mainly an agricultural country and has not yet developed its industries.

Why is it that this huge area is still united in spite of all the storms of war and revolution which have burst over it during the last ten years? One reason is that the Russias cover the great northern plains of Europe and Asia. In these plains there is no real break except the Ural Mountains, and they rise gently from the plain, a series of ranges with rounded summits, and form no serious barrier to road and rail. These mountains do not descend to the Caspian Sea, but leave a large gap where the river Ural runs through the steppes to the Caspian Sea. Because, then, there are no natural barriers other than the great rivers, it has been easy to extend Russian rule eastward to the Pacific and simple to maintain it by military operations.

This plain, in reality a plateau, in European Russia has a foundation of granite, over which the ages have spread a covering of sand and chalk and clay and, in huge areas of southern Russia, of what is called "black earth," a rich soil largely composed of the remains of vegetable matter. This black earth is so rich that wheat grown there needs no manuring, and all sorts of crops grow very luxuriantly. The wide steppe country in the southern basin of the Volga, and stretching eastward across the Ural River into southern Siberia, is practically treeless, and is used principally for pasturage. East of the Caspian the salty plain is almost desert. Great areas even of the fertile districts of south Russia are treeless.

THE GREAT IMPORTANCE OF RIVER AND CANAL TRAFFIC IN RUSSIA

Everywhere the slopes are very gradual, and the river currents are slow, except at the time of the melting of the snow, when the volume of water in the rivers is enormously increased. Because of the evenness of the land it is very easy to build canals from one river-system to another, and river transport is as important in Russia as rail transport. You can load up goods in London on a steamer, take it through the Kiel Canal and the Baltic to Petrograd, and right across Russia to Persia without unloading.

In Siberia the rivers are also of enormous length. But the courses of the Obi, the Yenisei and the Lena are northward from the Asiatic highlands to the Arctic Ocean, or, like the Amur, eastward to the Pacific. A summer sea route brings the riches of Siberia to the countries of the West by way of the Yenisei and the Kara Sea. This does away with the long railway journey to the Baltic and Pacific ports. But the sea service is very short each year, and the remoteness of Siberia accounts for its being undeveloped, though it has many kinds of mineral and vegetable wealth.

WHY RUSSIA HAS ALWAYS WANTED TO HOLD CONSTANTINOPLE

Archangel on the White Sea is frozen for many months of the year. The northern rivers are frozen in September, and only thaw in July; and even the Neva, on which Petrograd stands, is frozen from the end of November to the end of April. The way from the Black Sea ports to the Mediterranean, by which Russian grain is shipped, is watched over by Constantinople, and it may be blocked very easily in time of war. Because Russia has no easy way to the great trade routes of the world she has always longed to possess Constantinople. Her situation on the Baltic has been made worse by the loss of Riga and Reval.

Then there is also the difficult climate. The great plain offers no barrier to the winds which sweep across Asia and from the northern ocean; and there are no mountains to make the clouds give out their moisture. Except in the Far East, Russia does not feel the moderating influence of the ocean, and so is a country of extremes of temperature. In the long, cold winter the snow lies thick on the ground right down to the shores of the Caspian.

Spring comes with a sudden splendor in Russia, and by June it is so hot over the central and southern regions that it seems unbelievable that there ever can have been snow. The long winter hinders work of every kind. In many parts the peasant stays in his little cottage for months, going out only when absolutely necessary. He even sleeps on the great stove which is so important in his tiny home. Winter in the western districts is less severe; it becomes more rigorous as you go eastward. In the north the days are very long in summer and short in winter. At Archangel, on the White Sea, the longest day has 21 hours 48 minutes, and the shortest only 3 hours 12 minutes. Even in Petrograd there are "white nights" in summer, when it hardly grows dark at all. As far south as Moscow the summer nights are very light, and after ten in the evening the gilded domes of the churches still shine brightly in the afterglow.

A MOUNTAIN HALF A MILE HIGHER THAN HOOD

Though there are no big mountains in the middle of Russia, there are mighty mountains on her southern borders. Mount Demavend, in the Elburz range, is a giant among mountains, 7,700 feet higher than Mount Hood. The average height of the passes of the range is 11,000 feet. There is a good military road now over one of the passes by which the traveler can go to Tiflis, in Georgia; and there is a service of automobiles passing over it. The trip is one of the wildest and the most beautiful in the world. South of the main range, in Transcaucasia, there are other great ranges stretching down into Russian Armenia. In Asia the great mountains of the Altai range are still very little known. But all these mountains are very rich in minerals.

The plains of Russia are inhabited by a great number of races. It was across those plains that the Asiatic peoples came into Europe, the last of them, that known

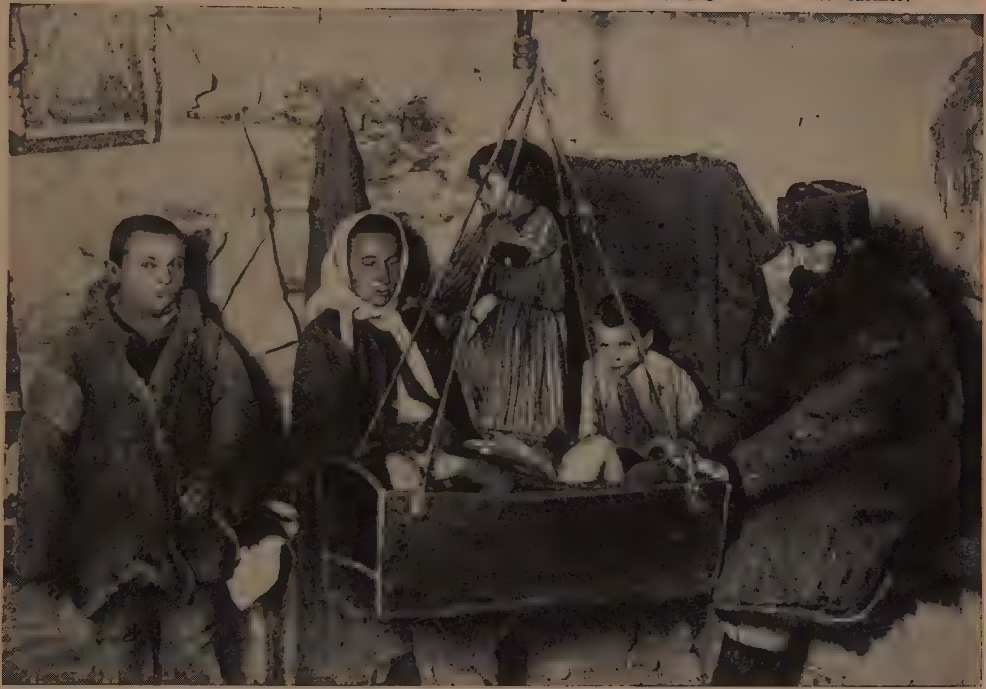
TYPES OF RUSSIAN PEASANTS

A farm worker.

A peasant.

A peasant woman.

A farmer.



A Russian peasant family at home.

Milkmaids of Kiev.

A peasant and his quaint cart.

as the Golden Horde, nearly seven hundred years ago. So to-day there are patches of different races all over Russia, with their own language, religion, manners and customs. They have kept their separateness and their differences the more easily because of the scanty means of communication. Soviet Russia has abandoned the name of Russia and is now the Union of Soviet Republics, so that every district, without regard to race, should have a share in the government of the whole. A soviet is a council elected only by workers, soldiers or peasants. But some of the republics in the Russian federation are not elected by soviets. Some are not socialist, though the larger republics are both soviet and socialist. It has become the habit to speak of Russia as a Bolshevik country, but, as a matter of fact, the word Bolshevik has no special significance in Russia, merely meaning the majority.

THE TWENTY-SIX REPUBLICS THAT MAKE UP THE RUSSIA OF TO-DAY

The Great Russians are the people who inhabit central Russia. They are Slavs, and the purest type is tall and fair. At present the freedom of the different races does not mean much, for the central government ruling in Moscow has complete control in important things. Local affairs can, however, be conducted in the local language and in accordance with local custom. In Russia now there are no less than twenty-six separate republics, six of them very important, like Great Russia, Ukrainia (the Ukraine), or Little Russia, and the Far Eastern Republic in eastern Siberia; but some are small, and little more than provinces. Georgia, Khiva, Bokhara and Russian Armenia are among the states which are non-Russian in their inhabitants, but are included in the new union.

There is a museum in Moscow where you may see to-day all the peoples of the Russian Union, "in their habit as they live." The models are of wax. They wear the local national costume, and are shown with their tools and ways of living.

THE COSSACKS WHO HELD BACK THE ASIATIC INVASIONS

There are the Slav races—the Great Russians, of whom there are between seventy and eighty millions, with the costumes worn in the different "governments," as the provinces are called; the Ukrainians, smaller and darker, with a softer speech and a love of art and color; the White Russians, who have their home in the marshy country between the Pripet and the South Dwina, and a host of others. The Cossacks of the Don belong to the Russian race, but have grown to be rather different because of the part they have had to play as the defenders of the steppe country against Asiatic invasion.

The Great Russians are the principal stock from which Siberia has been peopled. Then there are many branches of the Finno-Tartar family, with rather flat faces, high cheekbones and pronounced jaws. They are shorter in stature than the Russians. Of these there are Karelians, from the borders of Finland; Samoyedes, from the frozen north; and Tchuvashes, from the banks of the Volga. The Tartars are dark and short people, Asiatic in type. They have a separate republic of their own on the Volga with its capital at Kazan, and another in the Crimea. For the most part they are Mohammedan in religion.

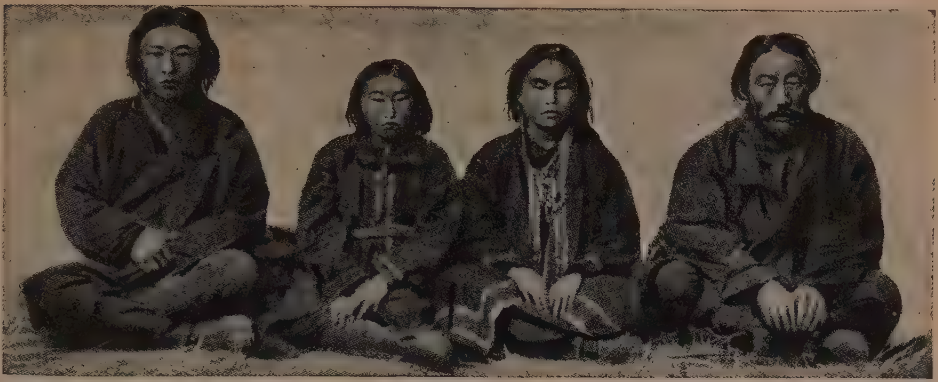
The mountain tribes of the Urals, too, have their own little state, the Mountain Republic. They are of Turkoman blood.

THE ROVING TRIBES THAT MOVE FROM PLACE TO PLACE

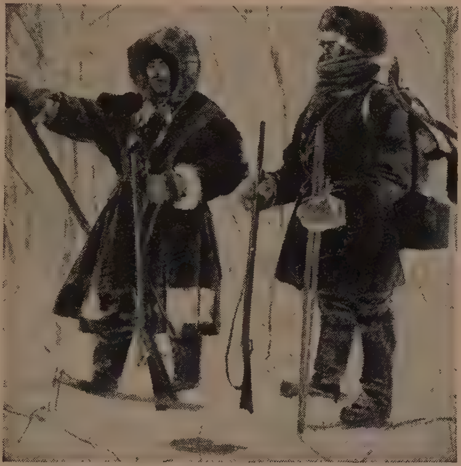
The Khirgiz, who are still nomads, are Tartars. They move with their flocks and herds, and deal in horses and cattle in the country between the Urals and the Caspian Sea. Another nomad tribe in the Caspian district, the Kalmucks, are a pure Mongol type, with slanting eyes like the Chinese. They follow the Lamaism of Tibet, and settle down with difficulty in one place. Around the Caucasus is a variety of races, one of which, the Circassians, is said to be the handsomest in the world. The Circassians wear gay, bright colors: blue and rose-red, or blue with bright silver accoutrements, or ornaments of inlaid black and silver.

So you will find in central Russia, in Siberia and Ukrainia, that the mass of the people speak the Russian language, in its two dialects of Great Russian and Little Russian. They belong to the Greek, or Orthodox, Church, the ritual of which has been handed down from the Greek Church established at Constantinople by the emperors of the East. In the towns of the Ukraine is a large Jewish population. In the Tartar state the Tartar language is spoken. It looks very much like Turkish in the inscriptions in the streets, and

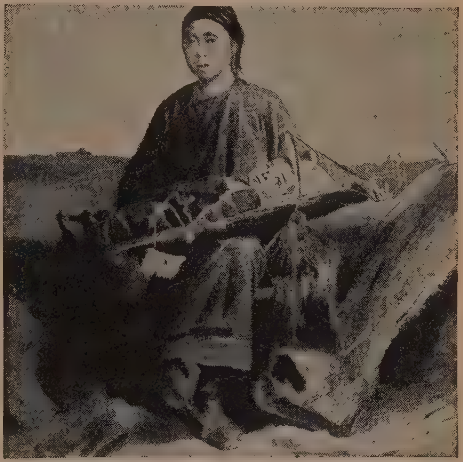
THE STRANGE PEOPLE OF LONELY SIBERIA



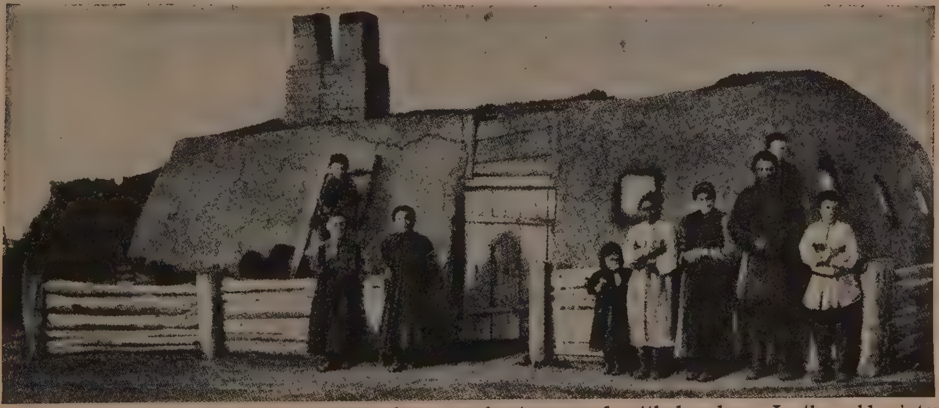
The people of Siberia are a mixture of many races that have from time to time conquered or migrated to this lonely land. The people shown in this picture are Tunguses, a race that lived originally in Manchuria, but wandered south, east and north into Siberia, their character largely influencing the peoples they conquered.



The Yakuts, shown in winter costume, are another race that went into Siberia from the south. They are more hardy and industrious than the Tunguses, through whose territory they fought their way.



Another Siberian race is that of the Giliaks, who live in the Amur valley. They are an ancient race, and related to the Ainos, the early inhabitants of Japan. In this picture we see a Giliak woman and her child.



The Yakuts, seen here and in the picture above, are huntsmen and cattle-breeders. In the cold winter months they live in curious houses like that shown here, with sloping walls made of wood, covered with clay, the roofs being of clay and peat. In summer they live a good deal in tents and in the open air.

side by side with the Christian churches are mosques with tall minarets crowned with the crescent. Turkestan is a purely Mohammedan state, with mosques and buildings in the Persian style. There the women are veiled, as they are in other Mohammedan countries. In the far north of Siberia, the inhabitants of Finnish type belonged to the Greek Church, but their customs show that they are really pagans rather than Christians.

THE GREAT BRIDGES THAT CARRY THE RAILWAYS OVER THE RIVERS

The distant parts of the Russian Union are linked up by the great Siberian Railway, which runs right across the continent of Asia from the Ural Mountains to Vladivostok. For the greater part of the way the line runs over level country, the chief difficulty from the engineering point of view being the great rivers, which require very long bridges. So precious are these bridges that they are always guarded. The travelers in the Volga steamboats, as the boat passes underneath the great bridge near Samara, are all sent down into the saloon, and the cabin windows shut in case anyone should attempt to damage the bridge. This is because of what happened in the World War and in the civil wars that followed, when about two thousand bridges on the various Russian railways were broken down. The repairing of these bridges has been one of the most expensive and difficult tasks the Russian Government has had to face.

THE TRAIN THAT RAN OVER THE ICE ON A FROZEN LAKE

Much of the flat country over which the greater part of the Siberian railway runs is forest. The engineers who built the line had a very difficult task when they reached the mountainous country around Lake Baikal. For many years the train was ferried over, or run over the ice in the winter, but now the line runs round the mountains on the south side of the lake. This railway has helped the colonization of the rich country of Siberia. Until it was built colonies were few and far between. Indeed, most of them were convict colonies of people who were sent to these lonely places because they were convicted of crime, or still oftener because they held political opinions which the rulers of Russia did not like. The administration of justice has always been, and still is, very harsh in Russia, and many people were exiled for trifling offenses, or for things which would not be classed as offenses in freedom-loving America.

The Russian railways are very good, but the rolling stock is different from ours. The distances to be covered are so great that everybody has to be provided with sleeping accommodation. So, long cars are fitted up with shelves on which the passengers can sleep. Everyone takes with him food for the journey, and when the train stops, the passengers crowd out with their teapots and fill them at a great tank of hot water provided at the stations. Everyone drinks tea in Russia in great quantities, but very weak. When they are too poor to buy tea, which has been very dear, as Russia has had very little money to spend abroad since the World War, they make an infusion of dried carrots or herbs and call it tea. At night the windows of the carriages are tight shut; then the shelves are pulled out, and every passenger on the train rolls himself up in a blanket, covers his face with a coat, and sleeps.

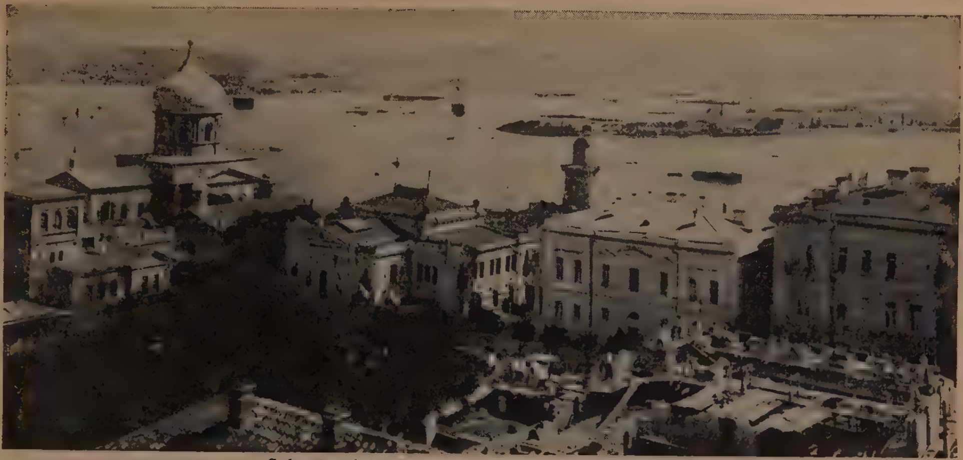
THE NATURAL WEALTH OF RUSSIA WHICH MAY MAKE HER PROSPEROUS AGAIN

For those who can afford to pay large sums of money there are the international sleeping-cars, with proper beds; but these are provided only on the fast trains which run on the main routes. The engines burn coal, wood or oil, according to the districts they serve, but usually wood.

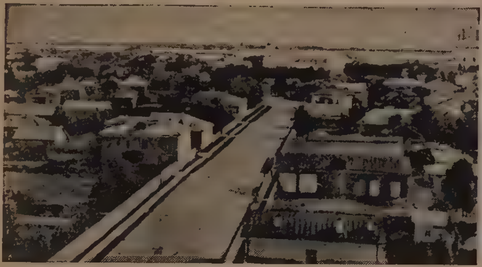
Russia suffered as heavily as any European country during the World War, and her losses in men were greater than those of any other power. After she fell out of the struggle she was torn by revolution, civil war and famine. Yet Russia may possibly recover from her troubles more rapidly than other European countries, because she has always depended less on science or industry for her prosperity than on her great natural resources. Of these the greatest is the soil.

There is, first, the vast wheat-growing area of the "black soil" of south Russia, in the Ukraine, the Kuban and other districts, and the even larger areas of central Russia and Siberia, where rye is the chief crop. Rye bread, a sweet tasting black bread and *kasha,* a kind of porridge made from millet and other grains, are the chief foods of the Russian people. "The Russian peasant," says the proverb, "sells his wheat, eats his rye, and feeds his oats

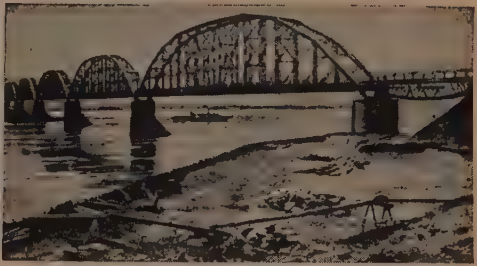
HERE AND THERE IN RUSSIA



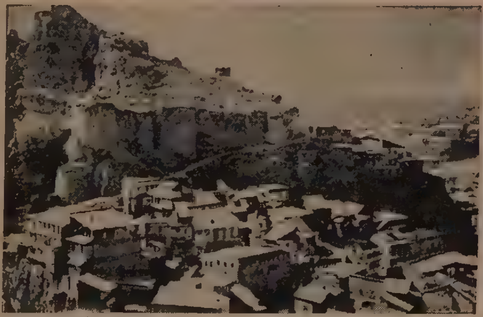
Sebastopol harbor, on the coast of the Crimea.



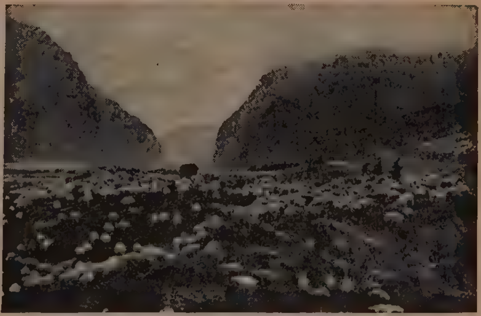
North Russian port of Archangel.



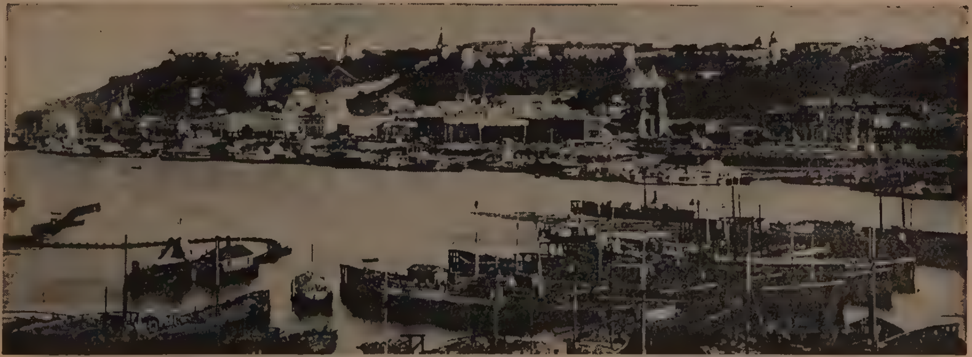
Yenisei Bridge, Trans-Siberian Railway.



The quaint town of Tiflis, Caucasia.



Sheep in a gorge in Ukrainia.



The city and harbor of Nijni Novgorod, the scene of the great fair.

to his horse." Since the Revolution the peasant owns most of the land and his house. The estates of the big landowners were divided up among the peasants, in some cases. In others, they were retained as large farms run by the Government, or by co-operative societies. But often the land belongs to the village as a whole.

This is an old custom which has survived in Russia, though it has been given up in most of the other countries. The land is divided into strips, and is redistributed every nine years. Ever since 1905 attempts have been made to change this system, but it is difficult to change. The Russian village consists of a street of wooden houses crowded together for company in the long winters, and for protection in former days against the wolves. Some of the plots are miles away, and the strip system gives every man a chance of getting one piece comparatively near his house. The stacks are also crowded together, and so are the cowhouses and stables. If there is a fire it is almost impossible to prevent it from spreading. In some villages you may see dug-outs in the rear of the houses in which the peasant can take shelter for himself, his family and his more treasured possessions in case of fire. The Russian peasant loves his live stock, and in the dairies and the stables, even on the large co-operative farms, one sees the pet names of the animals written up over their stalls.

THE CHIEF EXPORTS FROM RUSSIA IN HER HAPPIER DAYS

In good years Russia produces far more agricultural stuff than she can consume, and exports large quantities of grain, linseed, sunflower seed, and, from Siberia, butter and cheese. The cattle, horses and pigs of south Russia provide large quantities of hides, tallow and bristles for export. In sugar Russia was nearly self-supporting before the World War, the sugar being produced from the beet-fields of Ukrainia. Turkestan gives her large supplies of cotton, though not nearly enough to feed her mills, for, next to agriculture, cotton is the greatest Russian industry.

Another great source of wealth is the forests, which extend for miles in nearly all the districts of Russia except the south. In the north and on the Baltic are forests of larch and pine and other coniferous trees which in normal times supply enormous amounts of building timber for the countries of Western Europe.

In the centre are extensive woods of birch and pine, and farther south the woodlands contain oaks and elms. The white-stemmed birch is the most picturesque and characteristic of the Russian forest trees. Siberia is even richer in timber, and the northern forests there also provide much wealth from the skins of the valuable fur-bearing animals, the bear, the fox, the marten and the sable.

THE AMAZING WEALTH WHICH IS WAITING TO BE WON FROM THE EARTH

Russia has excellent supplies of coal, both ordinary and anthracite, in the Donetz Basin and in other parts of Ukrainia. These districts are also rich in iron, and there are great tracts of iron-bearing earth which have not yet begun to be worked. The Urals are rich in copper, platinum, iron and coal, and in the Altai Mountains and the mountains of eastern Siberia there are rich mines of gold and other metals. In other districts, and especially in the Moscow district, there are good supplies of brown coal, which can be easily turned into electrical power for working the factories, the tramways, and so on.

The chief towns of Russia are provided with electrical power stations, and these are being extended, so that in a few years Russia may be one of the countries in Europe best supplied with electrical power.

It is strange, in a village that is backward according to every modern standard, and where the peasants have no boots, but wear strips of cloth and linen bound round their feet, to find that electric power is available.

Then, on the plains between the Caucasus and the Black and Caspian seas, in Daghestan and Azerbaijan, of which the centres are Baku and Batum, there are rich oil wells which are one of Russia's most valuable possessions. In Sakhalin, part of which has been assigned to Japan, there are also oil wells from which ships putting in at Vladivostok can be supplied. Russia's natural resources are therefore almost unlimited, but they are only beginning to be made use of.

She is still poorly served by railroads; moreover, her rolling stock (especially her locomotives) has been all used up, first in the World War and later in the civil war.

HISTORIC SITES IN RUSSIA

The village of Balaclava, on the shores of the Black Sea.

Great Richelieu Stairway, Odessa.

Natives outside a mosque, Turkestan.

The Nicholas suspension bridge over the Dnieper River at Kiev.

THE SAD FATE OF THE SPLENDID CITY OF PETROGRAD

Under the tsars the capital city of Russia was St. Petersburg, or Petrograd, built by Peter the Great on the Neva to provide Russia with "a window looking out to the west." It grew into a splendid city, in spite of its bad climate, due to its being built on a swamp. The presence of the court made it the home of the whole class of civil servants and politicians.

Great industries, especially the textile and electrical, had big factories there, and with the deepening of the Neva there was a considerable shipping. Between 1918 and 1922 this great and splendid city fell into ruin, and is only gradually being repaired, but its population is much reduced because of the removal of the seat of government to Moscow. The Bolshevik government renamed it Leningrad. But Petrograd's prosperity will revive in due time, and the broad Neva, with its fine quays and splendid bridges, and the magnificent streets, the most famous of which is the Nevski Prospect, still remain the glory of the place from which for a time at least the glamour of imperial splendor has vanished.

PEASANT WOMEN CARRYING THEIR PRODUCE TO MARKET

Moscow is a very different city. It is one of the most interesting and romantic cities of Europe. It, too, is a great industrial centre—the greatest in Russia. But the factories for the manufacture of cotton, electrical goods and machinery, and a hundred other things are for the most part outside the city proper on the banks of the Moskva River. They do not, therefore, alter the character of the town. Moscow is gorgeous with color, and when the traveler catches sight of it for the first time, he realizes that he is nearing the East. Above the houses, the streets and the great buildings of the modern town rise the domes of the great Orthodox churches. Some glitter with gold, others are painted Madonna blue or sea-green. In the centre of the city is the old white-walled city. Its walls are called in Moscow the Chinese Walls. Between it and the Moskva River rises the Kremlin, the splendid medieval fortress which dominates the city.

The Kremlin is a walled inclosure, the

MOSCOW, CAPITAL OF SOVIET RUSSIA

In this view of Moscow we see the Cathedral of Vasili, one of the strangest buildings in the world. It has twenty domes and towers, all of different shapes, sizes and colors, and has been called "a nightmare in stone." It was built by an Italian architect at the command of Ivan the Terrible.

Moscow, historically the most famous city of Russia, is situated on the river Moskva. On the north bank of the river rises the Kremlin, for many centuries the centre of the political and religious life of Russia. East of the Kremlin is the commercial quarter of the city, known as Chinatown. Terrible fires have at times destroyed the monuments of Moscow.

walls of old red brick, and the gates all different but all beautiful. The towers are roofed with brilliant green tiles. Within the Kremlin stand the most magnificent and the most sacred of the city churches, the fine palaces of the old days, as well as the barracks and other buildings. There, in the great palace, richly decorated within in the style of Louis XIV, the Russian parliament, now called the All-Russian Congress of Soviets, meets every year.

One of the strangest buildings in Moscow is the Cathedral of Vasili, in the Red Square outside the Kremlin walls, begun by Ivan the Terrible. When the designs were finished, the architect had his eyes put out by the order of the tyrant, so that he might never build another like it. It is the oddest building, with a dozen twisted cupolas painted with bright blues, reds, greens and orange, and highly decorated.

Moscow's only rival in European Russia is Kiev, in Ukrainia, the holy city of Russia and still a place of pilgrimage for the devout. The churches are many and magnificent, and they possess many of the most revered icons and relics of the Russian Church. Everywhere the Russian churches blaze with pictures, with gilding and with color, though many of their treasures were surrendered at the order of the Soviet Government at the time of the famine in 1921. The Communist party, which rules Russia, is anti-religious, and does not allow its members to profess any creed; but the services of the churches still proceed, though the churches are poorer and have to be supported by the congregation. Some of the fine walled monasteries are left to the monks and nuns who belong to working communities, but some have been handed over for use as schools and clubs.

THE FORTRESS WHICH IS A PART OF MANY RUSSIAN CITIES

The cities of Russia are extraordinarily different. Every one has its history and its special characteristics. Many ancient cities have a kremlin, or fortress, not so magnificent as that of Moscow, but a walled inclosure standing on high ground and capable of defense in olden days. It contains the principal government offices, the most revered churches, and perhaps a convent. Novgorod the Great, once a very important place, before the rise of Petrograd, from which it is about 150 miles distant, has its kremlin. There is a very fine one at Nijni Novgorod. It stands high on the steep hill which rises up above the Oka River, and looks down on the island between the Oka and the Volga, where the great annual fair is held which brings the merchants of Asia and Russia together. There is another at Kazan, the capital of the Tartar Republic, where the Tartar towers and the Christian churches stand side by side. Even a purely industrial town like Tula, the centre of the iron industry in the Urals, has its kremlin, dating from the sixteenth century.

Saratov, on the Volga, has quiet, tree-shaded streets on the top of the heights above the Volga, and reminds one of a German town. It was once the home of a great many of the Germans who have their main settlement on the other side of the river. Odessa is, or was—for it has fallen into decay—a magnificent modern city and port. Its population was largely Jewish and foreign, and no doubt it will revive when the export of Russian grain begins again in earnest.

THE QUAINT TOWN WITH HOUSES LIKE FLIGHTS OF STAIRS

Baku, where many millions of rubles were made in oil before the World War, is entirely modern in its blackening industry and its streets, but is dominated by the ancient citadel of the Tartar khans. In Tiflis, again, there is a quaint native quarter, where the little balconied houses stand one above the other like flights of stairs on the steep sides of the valley in which the town lies. The city has an ordinary modern Russian quarter also.

East of the Urals and the Caspian the traveler is in Asia. As soon as you cross the Volga south of Saratov the steppe country is Asiatic in character, and the camel becomes the common beast of burden. The main cities of Siberia along the Siberian Railway are modern and Russian in character as regards their principal quarters. In the country between the Caspian and the Thian Shan and Altai Mountains the cities are ancient Asiatic cities, and the Russians are strangers.

THE HISTORIC CITY WHERE MANY NATIONALITIES MEET

There is Bokhara, with its cosmopolitan bazaars frequented by Persians, Khirgiz, Hindus, Armenians, Tartars, Turkomans, Afghans and Mongols. There is "golden

Samarkand," where the traveler can still visit the ruins of the mighty palaces built by Tamerlane, who conquered central Asia in the fourteenth century and made Samarkand his capital. Vladivostok, "Mistress of the East," is Russia's window on the Pacific. Unfortunately for her trade, this port is ice-bound from January to March every year.

The ordinary Russian town has a central square where are the principal buildings and the church, and from this square the streets radiate. In the business parts of the town the houses are of brick or stone, but as soon as you get into the suburbs the characteristic low Russian wooden house, with its elaborately carved window-frames, is seen. One curious thing is the fire-tower, with a little gallery high up where the watchman stands ready to signal if there is a fire. Then there is the bazaar, a vast, outside market where nearly everybody buys his food, and often clothes and other things as well. Everywhere, in town and country, the people are poor according to our standards. The houses are very crowded in many places. In this matter Moscow is perhaps the worst. There, with the coming of all the government officials, and traders connected with the government, there is literally not room to live. The available space is divided out, and even so, you may find a government official or an important business man obliged to be content with one or, at most, two rooms for himself and his wife and child. In the country the whole family—grandparents and one or two families of the sons—will continue to live in the one little wooden house all together.

In the winter people crowd into one room even if they have more, because they are often too poor to keep more than one room heated. But in the summer life is much gayer and happier, and everybody who possibly can flies from the town to a little cottage in the country, and there the family lives in the open air. All the meals are taken out on the big balcony, on which you may sit out until far into the long, light night around the samovar, or tea urn, which is the centre of the family life. By this open-air life stores of health are laid up to last through the long winter.

FINLAND

FINLAND declared itself an independent state in 1917 and a republic in June, 1919. It had then been a grand duchy of the Russian Empire for over a hundred years, with the Russian emperor as its grand duke. For over six hundred years before that it had been a part of Sweden, the country which brought civilization to the Finns.

Originally the Finns were an Asiatic people, speaking, as they still do, a tongue of the Mongolian type. Under Swedish influence they have developed into one of the best-educated and, physically and morally, finest races in Europe. Their national traits are still strongly marked. Neither the Swedes nor the Russians could cause them to weaken their hold on their Finnish selves.

The national feeling grew throughout the nineteenth century. This was largely because of the publication of legendary Finnish verse, making a long epic, the Kalevala. From this Longfellow took his metre for Hiawatha, a similar revival of Indian legends. The building-up of a literature in the Finnish language fostered the pride of the people as a distinct race. By their tyrannical attempts to Russianize the Finns the Russians only made them cling the more earnestly to their own ways, so that everyone knew that whenever a chance came, Finland would claim independence.

Including a part of Lapland, Finland has an area of about 149,000 square miles, and a population of about three and a half millions.

The capital, Helsinki (formerly Helsingfors), has 200,000 inhabitants, and Turku (formerly Abo) has about 60,000. In religion the people are almost exclusively Evangelical Lutherans.

Finland is a beautiful land of woods, lakes and streams, but without mountains. Its chief wealth is in its forests, used for house-building, wood industries and paper-making. Timber is exported. Agriculture is intelligently pursued, and the chief crops are rye, oats, barley and potatoes. Dairying is important. Iron is found in large quantities, and is prosperously worked. The Finns make excellent seamen, and the country has a fair mercantile fleet. Finland is one of the most attractive smaller countries.

ESTHONIA

THE newly formed Republic of Esthonia, which declared itself independent in February, 1918, and was acknowledged by Russia as independent in December, 1919, has an area of about 23,000 square miles. It extends along the south of the Gulf of Finland from the river Narova and Lake Peipus westward to the Baltic Sea. It includes the island of Dago.

Its population of over a million is almost entirely composed of Esths, a race akin to the Finns in descent and language. They are Lutheran in religion, and greatly superior to the Russians in education, whose rule they have always chafed against.

The work of the country is largely agricultural. Its chief crops are rye, barley, oats, potatoes and flax. A fifth of the land is forest. The exports are timber, flax, butter and meat. A large amount of produce passes through the country from Russia in ordinary times, and is shipped at the ancient port of Reval, or Tallinn, now the capital. Pernau, on the Gulf of Riga, is the next most important port. Dorpat, or Tartu, contains the national university. Narva, at the mouth of the river Narova, is the chief manufacturing town.

The frontier between Esthonia and Latvia on the south is not yet finally drawn, but the feeling between the Esths and Letts is friendly. The people of Esthonia are not to any large extent of mixed race. Recently they have advanced in numbers and prosperity.

LATVIA

LATVIA, a new republic on the Baltic coast, is the home of the Letts, a people akin in race and language to the Finns of Finland and the Esths of Esthonia. It has survived many invasions and conquests. Successively the Letts have been overrun by the Germans, the Poles, the Swedes and the Russians. Under Russia strong attempts were made to wipe out their language and national customs, but when the war ceased, in 1918, they claimed their independence, and asked for territory wherein their race numbered more than any other. This they obtained at the Peace Conference.

Latvia includes the former Russian province of Courland, part of Livonia and part of the province of Vitebsk, with the Island of Oesel at the mouth of the Gulf of Riga. It is a flat land of forests, lakes and rivers, grouped about the lower course of the river Dwina. It has an area of about 25,000 square miles and a population of two millions.

Its work is the same as that of Esthonia: the growing of rye, oats, barley, flax and potatoes, dairying and, above all, the use of the timber in its plentiful forests. Its capital, Riga, is the chief outlet for a great inland trade from as far as Siberia. Libau is the second port of the country.

The Letts are at home on the sea, and it is not easy to see how Russia will be a seafaring nation at all without them, the Esths and the Finns.

LITHUANIA

LITHUANIA, the most southern of the three nations formed from the Baltic states of Russia, is the least clearly defined. Bounded by Latvia, Prussia, Poland and Russia, it is not immediately clear how far in each direction the Lithuanian race extends as a majority. From its past history Lithuania has a right to independence. About the year 1400 it was one of the great states of Eastern Europe, extending from the Baltic to the Black Sea. By the marriage of the Lithuanian king with the queen of Poland the two countries became united, and Poland later became partner. Like Poland, Lithuania is Roman Catholic.

Early in the World War the Lithuanians claimed their independence. The Republic was not, however, fully organized till 1919, owing to the occupation of the country by German forces. Settlement was delayed by the Russian Government attacking Poland through Lithuania.

The country is about the same size as Portugal, and most of its 2,300,000 people are engaged in agriculture. Much of the land is forest, with marshy tracts. Cattle-rearing is much engaged in. The crops cultivated are: rye, oats, barley, potatoes, wheat and flax.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 5997.

RUSSIA'S SMALL NEIGHBORS AT HOME

Peasants of Latvia driving over the snows to market.

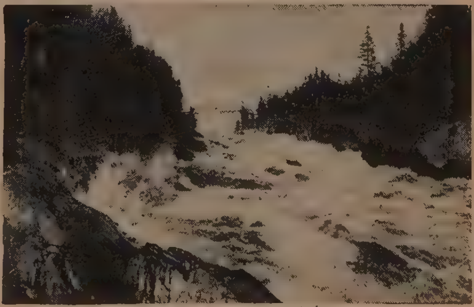
Greek Cathedral in Riga.

An old town gate in Reval.

The National Museum in Helsingfors.

Yacht harbor, Helsingfors.

A market scene in Lithuania.



Rapids near Helsingfors.

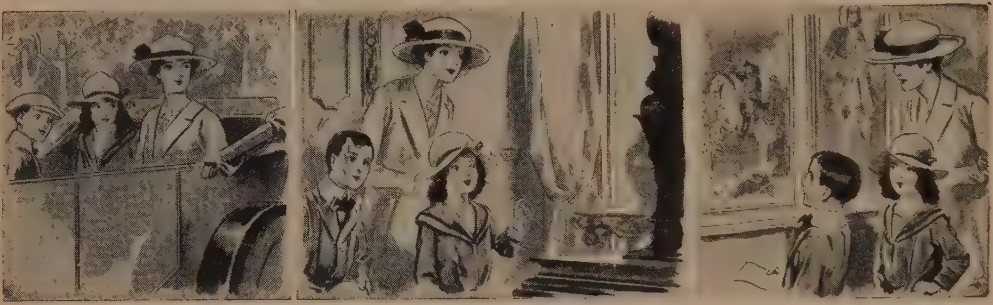
FRENCH—A DAY AT VERSAILLES

First line, French; second line, English word; third line, as we say it in English.

Aujourd'hui nous allons à Versailles, où demeurait une fois une belle reine.
To-day we go to Versailles, where dwelt one time a beautiful queen.
To-day we go to Versailles, where a beautiful queen once lived.

Nous arrivons à deux heures, et allons en voiture au palais, un édifice splendide.
We arrive at two hours, and go in carriage to the palace, an edifice splendid.
We arrive at two o'clock and drive to the palace, a fine building.

Nous traversons les chambres et regardons les beaux ameublements.
We traverse the rooms and regard the beautiful furniture.
We walk through the rooms and look at the beautiful furniture.

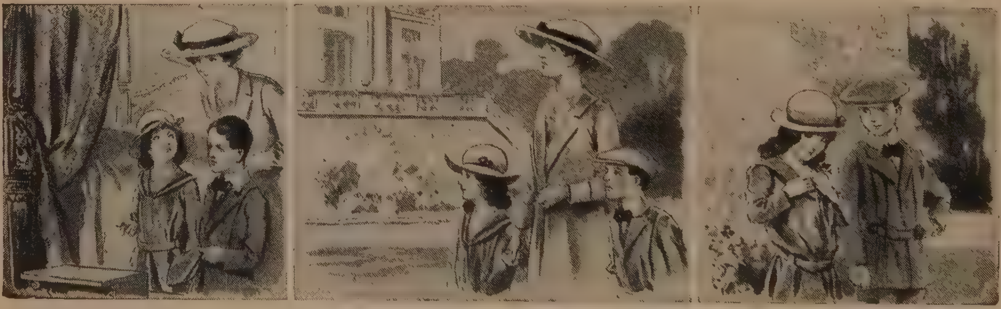


Il y a un grand nombre de tableaux sur les murs. J'aime les tableaux de bataille.
There is a great number of pictures upon the walls. I like the pictures of battles.
There are a great many pictures on the walls. I like the battle pictures.

Nous voyons des lits bizarres. Ils ont un petit escalier sur le côté.
We see some beds strange. They have a little staircase upon the side.
We see some strange beds. They have a little staircase at the side.

Les lits sont si hauts qu'on doit monter deux marches pour se coucher.
The beds are so high that one must to mount two steps for oneself to go to bed.
The beds are so high that one has to go up two steps to go to bed.

Nous quittons le grand palais, et nous entrons dans Le Petit Trianon.
We quit the great palace, and we enter into the little Trianon.
We leave the big palace, and we go into Le Petit Trianon.



Quelquefois la reine et ses amis demeuraient ici dans de petites maisons.
Sometimes the queen and her friends dwelt here in some little houses.
Sometimes the queen and her friends lived here in little houses.

Jeannette arrache un peu de lierre de la muraille et le met à sa robe.
Jenny plucks a little of ivy from the wall and it puts at her dress.
Jenny plucks a little bit of ivy from the wall and puts it in her dress.

Nous n'oublierons jamais le jardin de la malheureuse reine Marie Antoinette.
We (not) shall forget never the garden of the unhappy queen Marie Antoinette.
We shall never forget the garden of the unhappy queen Marie Antoinette.

THE NEXT FRENCH STORY IS ON PAGE 6090.

A BALLAD OF THE BORDERLAND

THE beautiful country on both sides of the Cheviot Hills, the Borderland between England and Scotland, is a region where the waters of many streams make music as they flow. This Borderland has always been famous for its legends, and many ballads have been collected in which these legends are told. James Hogg gave a new dress of poetry to one of these old legends in his famous ballad of Kilmeny. The story was an old one long before the poet heard it, and he told it in this beautiful musical way. Kilmeny is a lovely girl lost in the woods, and for seven years her mother mourns her. Then one day she comes home. She is strangely quiet, though, if anything, more beautiful than ever. She had been stolen away by the fairies. Then her heart had yearned for her old home, and the fairies had let her go back. But after a month and a day Kilmeny wanders again to the green-wood, and lying down there, she is borne away by the fairies, to return no more.

KILMENY: A FAIRY LEGEND

BONNY Kilmeny gaed up the glen;
But it wasna to meet Duneira's men,
Nor the rosy monk of the isle to see,
For Kilmeny was pure as pure could be.
It was only to hear the yorlin sing,
And pu' the cress-flower round the spring;—
The scarlet hypp, and the hind-berrye,
And the nut that hung frae the hazel-tree;
For Kilmeny was pure as pure could be.
But lang may her minny look o'er the wa',
And lang may she seek i' the green-wood shaw;
Lang the laird o' Duneira blame,
And lang, lang greet or Kilmeny come hame!

When many a day had come and fled,
When grief grew calm, and hope was dead,
When mass for Kilmeny's soul had been sung,
When the bedesman had prayed, and the dead-bell rung;
Late, late in a gloamin' when all was still,
When the fringe was red on the westlin hill,
The wood was sere, the moon i' the wane,
The reek o' the cot hung over the plain,
Like a little wee cloud in the world its lane;
When the ingle lowed wi' an eiry leme,
Late, late in the gloamin' Kilmeny came hame!

"Kilmeny, Kilmeny, where have you been?
Lang hae we sought baith holt and dean;
By burn, by ford, and green-wood tree,
Yet you are halesome and fair to see.
Where gat ye that joup o' the lily sheen?
That bonny snood o' the birk sae green?
And those roses the fairest that ever was seen?
Kilmeny, Kilmeny, where have you been?"

Kilmeny looked up wi' a lovely grace,
But nae smile was seen on Kilmeny's face;
As still was her look, and as still was her e'e,
As the stillness that lay on the emerant lea,
Or the mist that sleeps on a waveless sea.
For Kilmeny had been she knew not where,
And Kilmeny had seen what she could not declare;
Kilmeny had been where the cock never crew,
Where the rain never fell, and the wind never blew;
But it seemed as the harp of the sky had rung,
And the airs of heaven played round her tongue,
When she spake of the lovely forms she had seen,
And a land where sin had never been;
A land of love, and a land of light,
Withouten sun, or moon, or night;
Where the river swa'd a living stream,
And the light a pure celestial beam;
The land of vision, it would seem,
A still, an everlasting dream.

In yon green-wood there is a waik,
And in that waik there is a wene,
And in that wene there is a maike,
That neither has flesh, nor blood, nor bane;
And down in yon green-wood he walks his lane.

In that green wene Kilmeny lay,
Her bosom happed wi' the flowerets gay;
But the air was soft, and the silence deep,
And bonny Kilmeny fell sound asleep.
She kenned nae mair, nor opened her e'e,
Till waked by the hymns of a far countrye.

She woke on a couch of silk sae slim,
All striped wi' the bars of the rainbow's rim;
And lovely beings around were rife,
Who erst had travelled mortal life;
And aye they smiled and 'gan to spier:
"What spirit has brought this mortal here?"

"Lang have I ranged the world wide,"
A meek and reverent fere replied;
"Baith night and day I have watched the fair
Eident a thousand years and mair.
Yes, I have watched o'er ilk degree,
Wherever blooms femenitye;
But sinless virgin, free of stain,
In mind and body, fand I nane.
Never, since the banquet of time,
Found I a virgin in her prime,
Till late this bonny maiden I saw,
As spotless as the morning snaw:
Full twenty years she has lived as free
As the spirits that sojourn in this countrye.
I have brought her away frae the snares of men,
That sin or death she never may ken."

They clasped her waist, and her hands sae fair;
They kissed her cheek, and they kemmed her hair;
And round came many a blooming fere,
Saying: "Bonny Kilmeny, ye're welcome here!
Women are freed of the littand scorn;
O, blest be the day Kilmeny was born!
Now shall the land of the spirits see,
Now shall it ken, what a woman may be!
Many a lang year, in sorrow and pain,
Many a lang year through the world we've gane,
Commissioned to watch fair woman-kind,
For it's they who nurse the immortal mind.
We have watched their steps as the dawning shone,
And deep in the green-wood walks alone;
By lily bower and silken bed,
The viewless tears have been o'er them shed;
Have soothed their ardent minds to sleep,
Or left the couch of love to weep.
We have seen! we have seen! but the time maun come,
And the angels will weep at the day of doom!

"O, would the fairest of mortal kind
Aye keep these holy truths in mind,
That kindred spirits their motions see,
Who watch their ways with anxious e'e,
And grieve for the guilt of humanitye!
O, sweet to Heaven the maiden's prayer,
And the sigh that heaves a bosom sae fair!
And dear to Heaven the words of truth,
And the praise of virtue frae beauty's mouth!
And dear to the viewless forms of air
The mind that kythes as the body fair!

"O bonny Kilmeny! free frae stain,
If ever you seek the world again,
That world of sin, of sorrow, and fear,
O, tell of the joys that are waiting here;
And tell of the signs you shall shortly see;
Of the times that are now, and the times that shall be."

They lifted Kilmeny, they led her away,
And she walked in the light of a sunless day;
The sky was a dome of crystal bright,
The fountain of vision, the fountain of light;
The emerant fields were of dazzling glow,
And the flowers of everlasting blow.
Then deep in the stream her body they laid,
That her youth and beauty never might fade;
And they smiled on heaven, when they saw her lie
In the stream of life that wandered by.
And she heard a song,—she heard it sung,
She kenned not where; but sae sweetly it rung,
It fell on her ear like a dream of the morn,—
"O, blest be the day Kilmeny was born!
Now shall the land of the spirits see,
Now shall it ken, what a woman may be!
The sun that shines on the world sae bright,
A borrowed gleid frae the fountain of light;
And the moon that sleeks the sky sae dun,
Like a gouden bow, or a beamless sun,
Shall wear away and be seen nae mair;
And the angels shall miss them, travelling the air.
But lang, lang after, baith night and day,
When the sun and the world have fled away,
When the sinner has gane to his waesome doom,
Kilmeny shall smile in eternal bloom!"

They bore her away, she wist not how,
For she felt not arm nor rest below;
But so swift they wained her through the light,
'Twas like the motion of sound or sight;
They seemed to split the gales of air,
And yet nor gale nor breeze was there.
Unnumbered groves below them grew;
They came, they past, and backward flew,
Like floods of blossoms gliding on,
A moment seen, in a moment gone.
Ah, never vales to mortal view
Appeared like those o'er which they flew,
That land to human spirits given,
The lowermost vales of the storied heaven;
From thence they can view the world below,
And heaven's blue gates with sapphires glow,—
More glory yet unmeet to know.

They bore her far to a mountain green,
To see what mortal never had seen;
And they seated her high on a purple sward,
And bade her heed what she saw and heard,
And note the changes the spirits wrought,
For now she lived in the land of thought.—
She looked, and she saw nor sun nor skies,
But a crystal dome of a thousand dyes;
She looked, and she saw nae land aright,
But an endless whirl of glory and light;
And radiant beings went and came,
Far swifter than wind or the linkèd flame;
She hid her e'en frae the dazzling view;
She looked again, and the scene was new.

She saw a sun in a summer sky,
And clouds of amber sailing by;
A lovely land beneath her lay,
And that land had lakes and mountains gray:
And that land had valleys and hoary piles,
And marlèd seas, and a thousand isles;
Its fields were speckled, its forests green,
And its lakes were all of the dazzling sheen,

Like magic mirrors, where slumbering lay
The sun and the sky and the cloudlet gray;
Which heaved and trembled, and gently swung;
On every shore they seemed to be hung;
For there they were seen on their downward plain
A thousand times and a thousand again;
In winding lake and placid firth,
Like peaceful heavens in the bosom of earth.

Kilmeny sighed and seemed to grieve,
For she found her heart to that land did cleave;
She saw the corn wave on the vale;
She saw the deer run down the dale;
She saw the plaid and the broad claymore,
And the brows that the badge of freedom bore;
And she thought she had seen the land before.
She saw a lady sit on a throne,
The fairest that ever the sun shone on:
A lion licked her hand of milk,
And she held him in a leish of silk,
And a leifu' maiden stood at her knee,
With a silver wand and melting e'e;
Her sovereign shield, till love stole in,
And poisoned all the fount within.

Then a gruff untoward bedesman came,
And hundit the lion on his dame;
And the guardian maid wi' the dauntless e'e,
She dropped a tear, and left her knee;
And she saw till the queen frae the lion fled,
Till the bonniest flower of the world lay dead;
A coffin was set on a distant plain,
And she saw the red blood fall like rain.
Then bonny Kilmeny's heart grew sair,
And she turned away, and could look nae mair.

Then the gruff, grim carle girned amain,
And they trampled him down, but he rose again;
And he baited the lion to deeds of weir,
Till he lapped the blood to the kingdom dear;
And weening his head was danger-preef,
When crowned with the rose and clover leaf,
He gowled at the carle, and chased him away
To feed wi' the deer on the mountain gray.
He gowled at the carle, and he gecked at heaven;
But his mark was set, and his arles given.
Kilmeny a while her e'en withdrew;
She looked again, and the scene was new.

She saw below her, fair unfurled,
One half of all the glowing world,
Where oceans rolled and rivers ran,
To bound the aims of sinful man.
She saw a people, fierce and fell,
Burst frae their bounds like fiends of hell;
There lilies grew, and the eagle flew;
And she herked on her ravening crew,
Till the cities and towns were wrapped in a blaze,
And the thunder it roared o'er the land and the seas.
The widows they wailed, and the red blood ran,
And she threatened an end to the race of man.
She never lened, nor stood in awe,
Till caught by the lion's deadly paw.
O, then the eagle swinked for life,
And brainzelled up a mortal strife;
But flew she north, or flew she south,
She met wi' the gowl of the lion's mouth.

With a mooted wing and waefu' maen,
The eagle sought her eiry again;
But lang may she cower in her bloody nest
And lang, lang sleek her wounded breast,
Before she sey another flight,
To play wi' the norland lion's might.

But to sing the sights Kilmeny saw,
So far surpassing nature's law,
The singer's voice wad sink away,
And the string of his harp wad cease to play.
But she saw till the sorrows of man were by
And all was love and harmony;
Till the stars of heaven fell calmly away,
Like the flakes of snaw on a winter's day.

Then Kilmeny begged again to see
The friends she had left in her ain countrye,
To tell of the place where she had been,
And the glories that lay in the land unseen;
To warn the living maidens fair,
The loved of Heaven, the spirits' care,
That all whose minds unmeled remain
Shall bloom in beauty when time is gane.

With distant music, soft and deep.
They lulled Kilmeny sound asleep;
And when she awakened, she lay her lane,
All happed with flowers in the green-wood wene.
When seven lang years had come and fled,
When grief was calm, and hope was dead;
When scarce was remembered Kilmeny's name,
Late, late in a gloamin', Kilmeny came hame!
And O, her beauty was fair to see,
But still and steadfast was her e'e!
Such beauty bard may never declare,
For there was no pride nor passion there;
And the soft desire of maidens' e'en,
In that mild face could never be seen.
Her seymar was the lily flower,
And her cheek the moss-rose in the shower;
And her voice like the distant melodye,
That floats along the twilight sea.
But she loved to raike the lanely glen,
And keep afar frae the haunts of men;
Her holy hymns unheard to sing,
To suck the flowers and drink the spring.
But wherever her peaceful form appeared,
The wild beasts of the hills were cheered;
The wolf played blithely round the field;
The lordly byson lowed and kneeled;
The dun deer wooed with manner bland,
And cowered aneath her lily hand.
And when at eve the woodlands rung,
When hymns of other worlds she sung
In ecstasy of sweet devotion,
O, then the glen was all in motion!
The wild beasts of the forest came,
Broke from their bughts and faulds the tame,
And goved around, charmed and amazed;
Even the dull cattle crooned, and gazed,
And murmured, and looked with anxious pain
For something the mystery to explain.
The buzzard came with the throstle-cock;
The corby left her houf in the rock;

The blackbird alang wi' the eagle flew;
The hind came tripping o'er the dew;
The wolf and the kid their raike began,
And the tod, and the lamb, and the leveret ran;
The hawk and the hern attour them hung,
And the merle and the mavis forhooyed their young;
And all in a peaceful ring were hurled:
It was like an eve in a sinless world!

When a month and day had come and gane,
Kilmeny sought the green-wood wene;
There laid her down on the leaves sae green,
And Kilmeny on earth was never mair seen.
But O, the words that fell from her mouth
Were words of wonder, and words of truth!
But all the land were in fear and dread,
For they kendna whether she was living or dead.
It wasna her hame, and she couldna remain;
She left this world of sorrow and pain,
And returned to the land of thought again.

WHEN YOU ARE OLD

This beautiful setting of the thought that long after we are dead our love may sustain and comfort and cheer those whom we have loved and lost is from the pen of William Ernest Henley, one of the most vigorous and fearless poets of the last generation.

WHEN you are old, and I am passed away,
Passed, and your face, your golden face, is gray,
I think, whate'er the end, this dream of mine,
Comforting you, a friendly star will shine
Down the dim slope where still you stumble and stray.

So may it be: that so dead Yesterday,
No sad-eyed ghost, but generous and gay,
May serve you memories like almighty wine,
When you are old.

Dear Heart, it shall be so. Under the sway
Of death the past's enormous disarray
Lies hushed and dark. Yet, though there come no sign,
Live on well pleased: immortal and divine
Love shall still tend you, as God's angels may,
When you are old.

THE DISCOVERER

Edmund Clarence Stedman was a distinguished American poet who died in 1908, in his seventy-fifth year. The charm of his verse ought to make it widely read wherever the English tongue is spoken. In this poem the writer is in a tender mood, for the "discoverer" of whom he speaks is any little child that dies and all too soon sets out on the great mysterious journey to the unknown land. The Discoverer is, in a sense, another kind of Peter Pan.

I HAVE a little kinsman
Whose earthly summers are but three,
And yet a voyager is he
Greater than Drake or Frobisher,
Than all their peers together!
He is a brave discoverer,
And, far beyond the tether
Of them who seek the frozen Pole,
Has sailed where the noiseless surges roll.
Ay, he has travelled whither
A winged pilot steered his bark
Through the portals of the dark,
Past hoary Mimir's well and tree,
Across the unknown sea.

Suddenly, in his fair young hour,
Came one who bore a flower,
And laid it in his dimpled hand
With this command:
"Henceforth thou art a rover!
Thou must make a voyage far,
Sail beneath the evening star,
And a wondrous land discover."
—With his sweet smile innocent
Our little kinsman went.

Since that time no word
From the absent has been heard.
Who can tell
How he fares, or answer well
What the little one has found
Since he left us, outward bound?
Would that he might return!
Then should we learn
From the pricking of his chart
How the skyey roadways part.
Hush! does not the baby this way bring,
To lay beside this severed curl,
Some starry offering
Of chrysolite or pearl?

Ah, no! not so!
We may follow on his track,
But he comes not back.
And yet I dare aver
He is a brave discoverer
Of climes his elders do not know.
He has more learning than appears
On the scroll of twice three thousand years,
More than in the groves is taught,
Or from furthest Indies brought;
He knows, perchance, how spirits fare,—
What shapes the angels wear,
What is their guise and speech
In those lands beyond our reach,—
And his eyes behold
Things that shall never, never be to mortal hearers told.

THE FLIGHT OF THE ARROW *

Richard Henry Stoddard, a notable poet, was born in 1825 and died in 1903. His poems were not so well known in other countries as those of other Americans, such as Longfellow, Whittier and Lowell; but he was a writer of distinction. Following the example of Longfellow in his poem beginning "I shot an arrow into the air," he makes use of the arrow's flight to illustrate a great lesson in life.

THE life of man
Is an arrow's flight,
Out of darkness
Into light,
And out of light
Into darkness again;
Perhaps to pleasure,
Perhaps to pain!

There must be Something,
Above, or below;
Somewhere unseen
A mighty Bow,
A Hand that tires not,
A sleepless Eye
That sees the arrows
Fly, and fly;
One who knows
Why we live—and die.

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JESUS, LOVER OF MY SOUL

There is no finer hymn in the English language than this beautiful composition by Charles Wesley, the brother of John Wesley, who founded the Methodist Church. Charles Wesley was born in 1707 and died in 1788, his life being full of religious activity and earnest spreading of the Gospel. He composed in all some six thousand hymns, only a few of which are still in use, but "Jesus, lover of my soul" is certainly unsurpassed in all the range of sacred song. It is said that the author was sitting one day at his desk when a bird, pursued by a hawk, flew in at the open window. The hawk, afraid to follow, flew away, and Wesley, struck by the incident, was at once inspired to write this song.

JESUS, lover of my soul,
Let me to Thy bosom fly,
While the nearer waters roll,
While the tempest still is high!
Hide me, O my Saviour, hide,
Till the storm of life is past;
Safe into the haven guide,
Oh receive my soul at last!

Other refuge have I none;
Hangs my helpless soul on Thee;
Leave, ah! leave me not alone,
Still support and comfort me!
All my trust on Thee is stayed,
All my help from Thee I bring;
Cover my defenseless head
With the shadow of Thy wing.

Wilt Thou not regard my call?
Wilt Thou not accept my prayer?
Lo! I sink, I faint, I fall,—
Lo! on Thee I cast my care;
Reach me out Thy gracious hand,
While I of Thy strength receive!
Hoping against hope I stand,—
Dying, and behold I live!

Thou, O Christ, art all I want,
More than all in Thee I find:
Raise the fallen, cheer the faint,
Heal the sick, and lead the blind!
Just and holy is Thy Name,
I am all unrighteousness;
False and full of sin I am,
Thou art full of truth and grace.

Plenteous grace with Thee is found,—
Grace to cover all my sin;
Let the healing streams abound;
Make and keep me pure within:—
Thou of life the Fountain art,
Freely let me take of Thee;
Spring Thou up within my heart,
Rise to all eternity!

A STANZA ON FREEDOM

The well-known poet James Russell Lowell was always a sturdy singer in the cause of freedom. In these lines he admirably expresses the ideal of freedom, for it is better "to be in the right with two or three" and suffer in consequence than to be comfortably in the wrong with the many.

THEY are slaves who fear to speak
For the fallen and the weak;
They are slaves who will not choose
Hatred, scoffing, and abuse,
Rather than in silence shrink
From the truth they needs must think;
They are slaves who dare not be
In the right with two or three.

THE GOOD GREAT MAN

Here is a short poem which may be described as a gem in every sense. The noble and inspiring thought which it contains is expressed in language of simple beauty and dignity. The lesson it teaches us is one easy to understand, if difficult to put in practice! For the more we know of life, the more sure shall we be that the poet is right in thinking "goodness and greatness are not means, but ends." There is a familiar saying: "Virtue is its own reward." This means that to do the right thing for the sake of the right, is the greatest reward that virtue can obtain. That is the lesson to be learned from this fine little poem by Samuel Taylor Coleridge, the author of The Ancient Mariner.

HOW seldom, friend, a good great man inherits
Honour and wealth, with all his worth and pains!
It seems a story from the land of spirits
When any man obtains that which he merits,
Or any merits that which he obtains.

Reply to the above

For shame, dear friend! renounce this canting strain!
What wouldst thou have a good great man obtain?
Wealth, title, dignity, a gilded chain,
Or throne of corses which his sword hath slain?
Greatness and goodness are not means, but ends.
Hath he not always treasures, always friends,—
The good great man? Three treasures,—love, and light,
And calm thoughts, equable as infant's breath;
And three firm friends, more sure than day or night,—
Himself, his Maker, and the angel Death.

LORD, IT BELONGS NOT TO MY CARE

Richard Baxter was an English Presbyterian minister who had a long eventful life between the years 1615 and 1691, being sometimes eminent in the religious affairs of his country, but often subject to persecution. He wrote much, both in prose and verse. The following is a good example of his religious poetry.

LORD, it belongs not to my care,
Whether I die or live;
To love and serve Thee is my share,
And this Thy grace must give.

If life be long I will be glad,
That I may long obey;
If short—yet why should I be sad
To soar to endless day?

Christ leads me through no darker rooms
Than He went through before;
He that into God's kingdom comes,
Must enter by His door.

Come, Lord, when grace hath made me meet
Thy blessed face to see;
For if Thy work on earth be sweet,
What will Thy glory be?

Then I shall end my sad complaints
And weary sinful days;
And join with the triumphant saints
To sing Jehovah's praise.

My knowledge of that life is small,
The eye of faith is dim;
But 'tis enough that Christ knows all,
And I shall be with Him.

LITTLE VERSES FOR VERY LITTLE PEOPLE

YOU are going out to tea to-day,
So mind how you behave;
Let all accounts I have of you
Be pleasant ones, I crave.

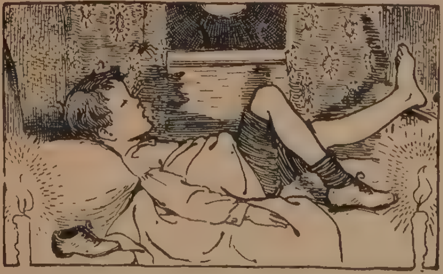
Don't spill your tea, or gnaw your bread,
And don't tease one another;
And Tommy mustn't talk too much,
Or quarrel with his brother.

Say "If you please," and "Thank you, Nurse."
Come home at eight o'clock;
And, Fanny, pray be careful that
You do not tear your frock.

Now, mind your manners, children five,
Attend to what I say;
And then, perhaps, I'll let you go
Again another day.

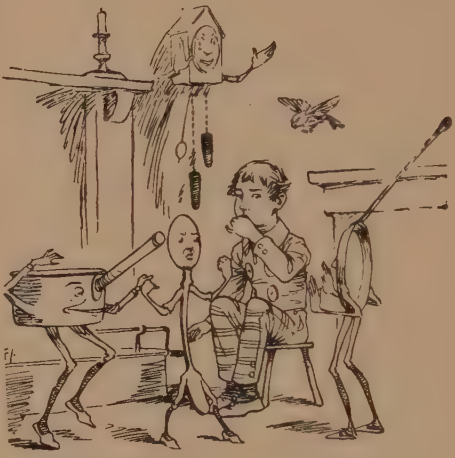
A LITTLE BOY THAT CRIED

ONCE a little boy, Jack, was ever so good,
Till he took a strange notion to cry all he could.
So he cried all the day, and he cried all the night,
He cried in the morning and in the twilight;
He cried till his voice was as hoarse as a crow,
And his mouth grew as large as a capital O.
It grew at the bottom, and grew at the top;
It grew till they thought it never would stop.
Each day his mouth grew taller and taller.
And his dear little self grew smaller and smaller.
At last that same mouth grew so big that, alack!
It was only a mouth with a border of Jack.



DIDDLE, diddle dumpling, my son John,
He went to bed with his stocking on;
One shoe off, and one shoe on,
Diddle, diddle dumpling, my son John.

ON Christmas Eve I turned the spit,
I burnt my fingers, I feel it yet;
The cock sparrow flew over the table,
The pot began to play with the ladle;
The ladle stood up like an angry man,
And vowed he'd fight the frying-pan;



The frying-pan behind the door
Said he never saw the like before;
And the kitchen clock I was going to wind
Said he never saw the like behind.

GREAT A, little A,
This is pancake day;
Toss the ball high,
Throw the ball low,
Those that come after
May sing heigh-ho!

JACK JINGLE went 'prentice
To make a horse-shoe,
He wasted the iron
Till it would not do.
His master came in
And began for a rail;
Says Jack: "The shoe's spoiled,
But 'twill still make a nail."

He tried at the nail,
But, chancing to miss,
Says: "If it won't make a nail,
It shall yet make a hiss";
Then into the water
Threw the hot iron, smack!
"Hiss!" quoth the iron;
"I thought so," says Jack.

NURSERY RHYMES OF CHILDREN OF FRANCE

JE suis un petit poupon
De belle figure,
Qui aime bien les bonbons
Et les confitures.
Si vous voulez m'en donner
Je saurai bien les manger—
La bonne aventure! Oh, gai!
La bonne aventure!

Lorsque les petits garçons
Sont gentils et sages,
On leur donne des bonbons,
De jolies images.
Mais quand ils se font gronder,
C'est le fouet qu'il faut donner—
La triste aventure! Oh, gai!
La triste aventure!

Je serai sage et bien bon,
Pour plaire à ma mère;
Je saurai bien ma leçon,
Pour plaire à mon père.
Je veux bien les contenter,
Et s'ils veulent m'embrasser—
La bonne aventure! Oh, gai!
La bonne aventure!

AH! vous dirai-je, Maman,
Ce qui cause mon tourment!
Papa veut que je raisonne
Comme une grande personne;
Moi je dis que les bonbons
Valent mieux que la raison.

PAN! Qu'est-ce qu'est là?
C'est Polichinelle,
Mam'selle.
Pan! Qu'est-ce qu'est là?
C'est Polichinelle, que voilà!

Toujours joyeux,
Il aime fort la danse,
Il se balance,
D'un petit air gracieux;
Pan! Qu'est-ce qu'est là?
C'est Polichinelle, que voilà!

Il est mal fait
Et craint de vous déplaire,
Mais il espère
Vous chanter son couplet;
Pan! Qu'est-ce qu'est là?
C'est Polichinelle, que voilà!

A vous faire rire,
Mes enfants, il aspire
Jeunes et vieux
Ceux qui rient sont heureux;
Pan! Qu'est-ce qu'est là?
C'est Polichinelle, que voilà!

I'M a chubby little thing,
Rather pretty too,
I *often* eat the sweets folks bring,
And jam I *always* do.
Just give me some, and I will show
The way to eat them up I know.
'Tis awful fun. Oh, joy!
'Tis awful fun.

'Tis very nice when little boys
Do just what boys should do;
Folks give them sweets and often toys,
And pretty pictures too.
But when they're naughty, I believe,
A whipping then is what folks give.
'Tis awful sad. Oh, joy!
'Tis awful sad.

I will be very, very good,
To please my dear Mamma,
And learn my lessons, as I should,
To please my dear Papa.
I always want to do what's right
When Mummy cuddles me up tight.
'Tis awful fun. Oh, joy!
'Tis awful fun.

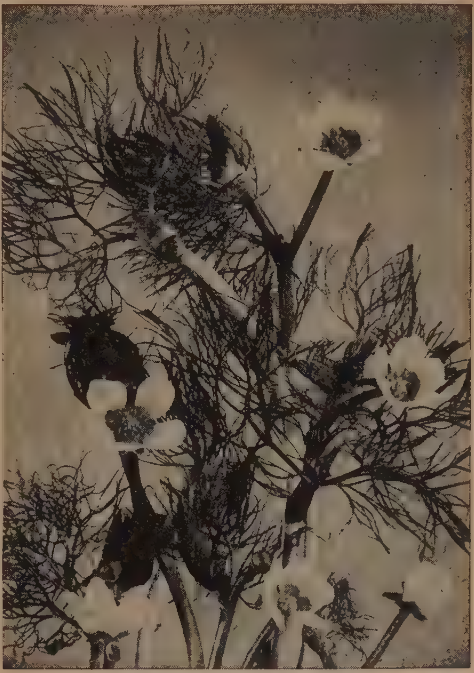
DARLING Mother, shall I say
Why I feel so sad to-day?
Daddy thinks I ought to know
As much as quite a *big* fellow!
I think games, with sweets for prize,
Better far than being wise.

HALT! Who goes there?
Punchinello,
My fine fellow!
Halt! Who goes there?
Punchinello! Right here!

Always debonair,
He is fond of a dance,
To retire and advance,
With a courtly air.
Halt! Who goes there?
Punchinello! Right here!

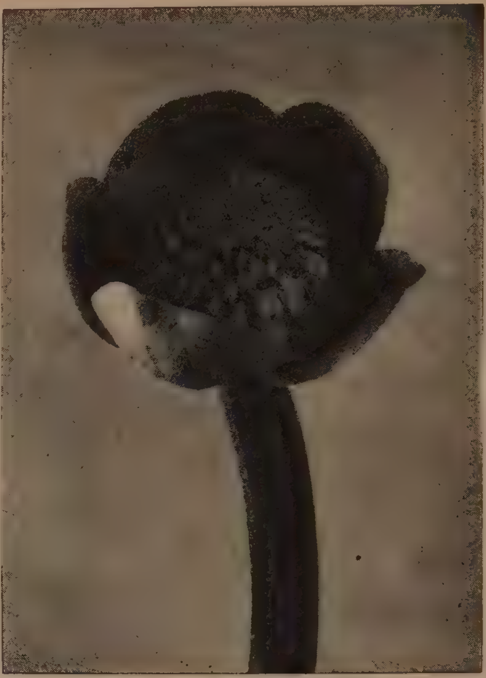
He fears he is wrong;
But yet, in despite,
He'll sing you a song,
If you will invite.
Halt! Who goes there?
Punchinello! Right here!

To cure all who mope,
My friends, is his hope.
Laugh, Age and Youth,
And be happy in truth,
Halt! Who goes there?
Punchinello! Right here!



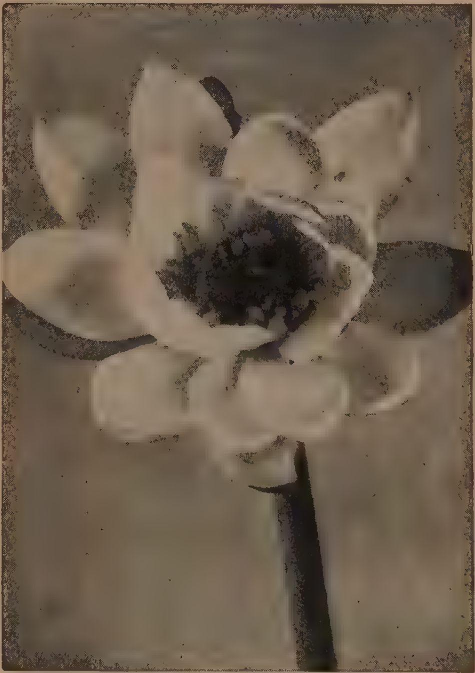
THE WATER CROWFOOT

The Water Crowfoot is one of the buttercups. The flower is white, and often a sluggish stream will be a mass of white owing to the crowfoot growing in the shallow waters.



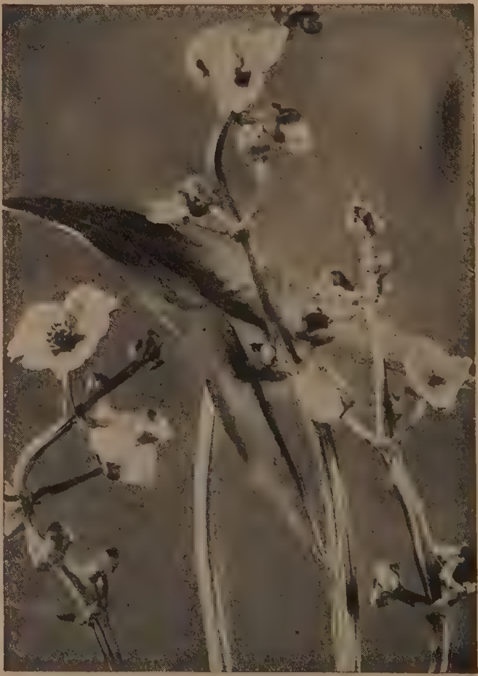
THE YELLOW WATER LILY

This flower has an unpleasant odor like alcohol, and in England is called the Brandy-bottle. The submerged leaves are thin, but the floating ones thick. The Turks make a drink from the flowers.



THE WHITE WATER LILY

While the flower of the yellow water lily grows an inch or two above the water, the White Water Lily is found resting on the surface. Many think that this is our handsomest wild flower.



THE ARROWHEAD

No one can mistake the leaf of the Arrowhead, for it is in shape exactly like an arrow. The plant grows in shallow streams near the banks. The white flowers are found in groups of three.

THE FLOWERS OF THE STREAM

ONE general characteristic strikes us when wandering by the stream in search of flowers—that most of the plants are tall and have comparatively slender leaves. This does not apply to those that float or spread their leaves upon the surface of the water; in these the leaves which float on the surface are very broad and greasy to the touch, so that the water rolls off. The advantage of this characteristic is that these plants have their air-mouths on the upper surface of the leaves; it would be harmful to have them blocked up by drops of water.

The plants that stand up along the margins of the stream have two reasons for possessing slender leaves. They grow in crowds, and, as in the case of the grasses, the slender leaf allows a greater number to grow in a narrow space because it enables the light from above to benefit all.

Some plants whose broad leaves float on the surface of the stream have leaves of a very different shape under the water, where breadth would be of no value to them, and where, in order to obtain enough of the small amount of carbon dioxid that is dissolved in the water, they must expose as large a surface as possible to it. This difference between the floating and the submerged leaf is shown well in the Water Crowfoot. This is a buttercup that has taken to living in water. When buttercups are grown from seeds, their first leaves are just the shape of the water crowfoot's floating foliage. In spring many ponds and parts of streams are covered with the crowfoot's white flowers.

If we can get a grown-up friend to hook out a plant, we shall find its stems are very long and soft, and from under-water branches a number of dark green coarse hairs are produced. If, now, we put a piece of the plant into a glass vessel of water, we shall see that these hairs are really the fine divisions of the under-water leaf which spread in all directions; while the round or kidney-shaped floating leaves, which are merely divided into three or five broad lobes, are for the purpose of keeping that end of the plant up, so that the flowers can open in the air. These flowers are very similar in their appearance to those of the buttercups, except that the petals are usually white. We have also a yellow crowfoot which is common in many sections of Canada and the United States.

Before winter comes the water crowfoot has thrown off its floating leaves and withdrawn its living portions largely into the mud, to be safe until spring, when it will again grow.

In the American Frog's Bit, which

prefers still waters, we have a floating plant, for its roots never reach the bottom. The name comes from a Greek word meaning "living in pools." The leaves lie flat on the surface of the water, and are either round or heart-shaped, green above and purplish beneath. Looked at under the microscope they are found to be spongy and put together like so many little nets. The flowers are almost as large as the leaves, with three sepals and three thin white petals.

The frog's bit has no stems to pull it downward to a place of safety, and probably if it remained on the surface, it might be destroyed when the upper waters were turned into thick ice. So in the autumn it sends out short shoots, or runners, and at the end of each develops a bud, which falls off and sinks into the muddy bottom, where it lies quietly all through the winter. In spring it wakes up, swells with growth, and rises to the surface, where it soon puts forth a great number of little floating leaves and roots. It flowers in July.

THE WATER SOLDIER, A NATIVE OF EUROPE

A near relative of the American frog's bit is known as the Water Soldier because all its leaves are sword-shaped, like those of the flag, but their edges are strongly toothed like the edge of a saw. It is a native of Europe, but is frequently seen in aquaria, in which the plants thrive and spread quickly. During the greater part of the year it remains at the bottom. It has flowers like the frog's bit, but larger, and when these are formed the plant rises to the surface.

THE WATER THYME THAT LIVES IN STREAMS AND PONDS

Yet another European relative of the frog's bit is the Water Thyme, which may be found in all sorts of fresh waters. It has long brittle stems that are almost transparent, closely set with short oblong leaves in whorls of threes. The purplish green flowers are very small, and consist of three sepals and three petals. This would be suitable also for aquaria.

THE BEAUTIFUL YELLOW AND WHITE WATER LILIES

The most showy of our floating water flowers are those of the two Water Lilies—yellow and white. In many places both may be found in the same water. They are not usually found where the water is more than fifteen feet deep, and they prefer places where there is no strong current. They are both rooted in the mud of the bottom, and have thick fleshy rootstocks. The large leathery heart-shaped leaves that lie flat on the surface, and do not retain water on top, are much alike in the two species. But the flowers, even apart from their color, are very different.

The yellow water lily never opens wide, but always remains ball-shaped; it is entirely yellow—sepals, petals, stamens and pistil. There are five or six large sepals, inclosing about twenty small and narrow petals, which bear nectar-glands.

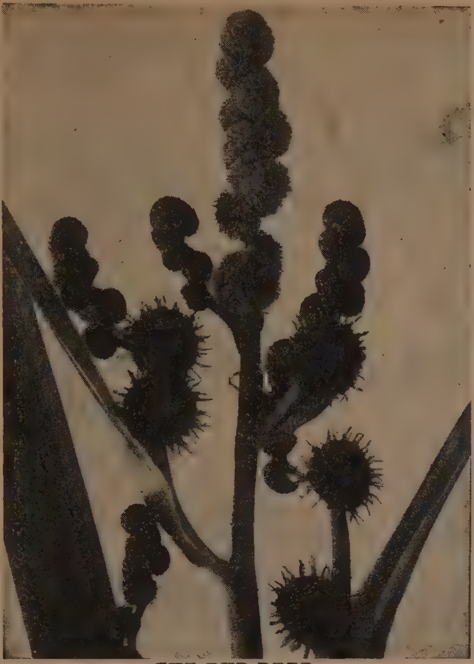
The white water lily is not so common as the yellow, and is generally found on larger sheets of water. It has only four sepals, and these are colored green on the outside and white on the inside. They spread wide when the flower is open, and the numerous petals in several rows so dispose themselves that the flower has a very full and attractive appearance. The petals that are next to the sepals are large, and each row becomes smaller toward the centre, so that the only thing that marks them as distinct from the broad stamens is the presence of the anthers. They are to be found from June to September. In the deep woods deer and moose come down to the edges of the lakes to feed upon their succulent roots.

THE ARROWHEAD WHICH EVERYONE CAN RECOGNIZE

Among the plants whose roots are in the bed of the stream with leaves and flowers in the air is the Arrowhead, whose leaves alone will enable us to recognize it though we may never have seen it before. They are of regular arrowhead shape, and while some lie on the surface, others stand up. Those that are submerged are thin and almost transparent.

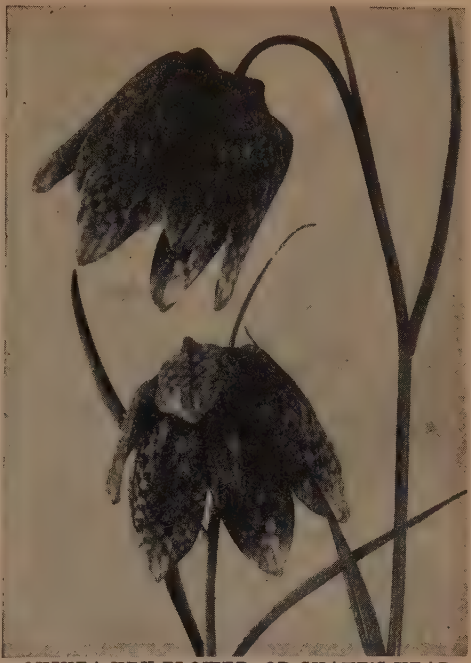
A tall leafless flowering stem arises from the centre of the arrowhead leaves, and at regular intervals this sends off short branches in threes, each branch ending in a flower nearly an inch across. This consists of three green sepals and three white petals with a purplish base. The lower flowers have no stamens, and are smaller than those above, which have many purple stamens but no pistils.

The pistillate flowers develop into large round fruits. From the swollen



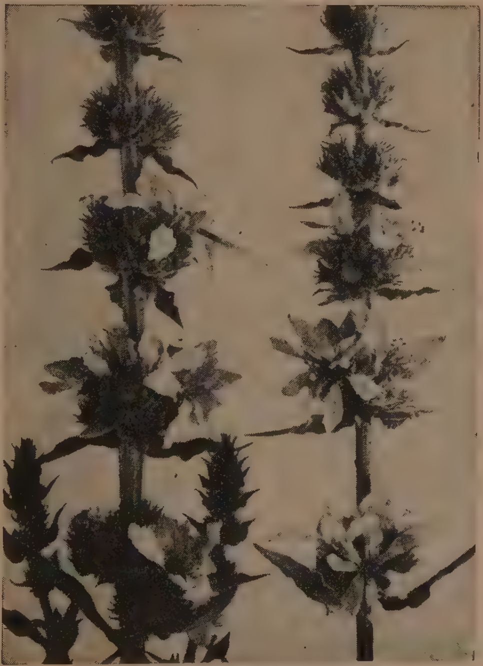
THE BUR-REED

The branched Bur-reed is a large graceful plant which lives in ditches and ponds. The leaves are sword-shaped, and the flowers of two kinds, some small and olive-colored, others larger and green.



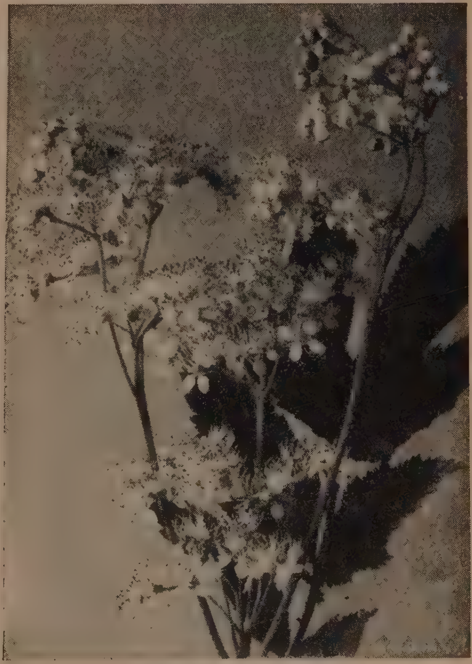
GUINEA-HEN FLOWER, OR SNAKE'S-HEAD

This plant, also called the Fritillary, gets the name Snake's-head from the fancied resemblance of the bud to a serpent's head. The purple flowers are not unlike tulips, but they droop from the stalks.



THE PURPLE LOOSESTRIFE

The Purple Loosestrife is a handsome plant, and its reddish purple flowers, growing in tall spikes among the rushes of a ditch or stream, might be mistaken for foxgloves at a distance.



THE MEADOW-SWEET

This English Meadow-sweet with creamy white fragrant blossoms and handsome foliage is often cultivated in old-fashioned gardens here. The American meadow-sweet is white or pink.

THE WATER PLANTAIN

This plant is misnamed. It is no relative of the true plantains, although its large veined leaf is something like that of the greater plantain. The flowers are pink, and the plant is found in water.

THE FLOWERING RUSH

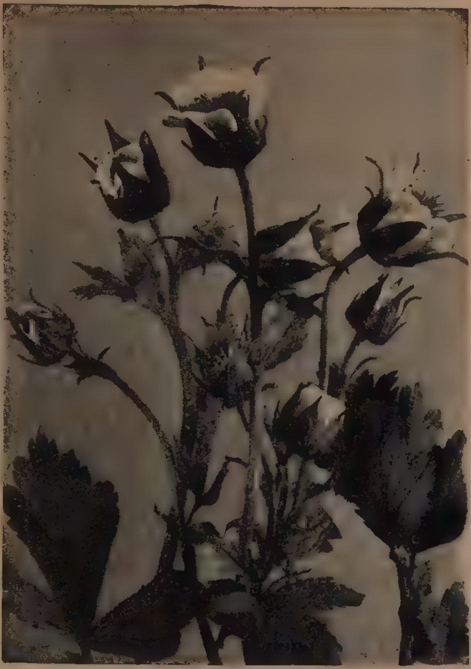
The Flowering Rush, which is not really a rush at all, is an attractive plant with tall stem of rose-pink flowers, growing out of reach of the banks of the European streams. Its flower is its beauty.

THE GIANT DOCK

The Giant Dock, or Great Water Dock, is a picturesque plant frequently found on our river-banks. The lance-shaped leaves are more than a foot long, but the green blossoms are not very attractive.

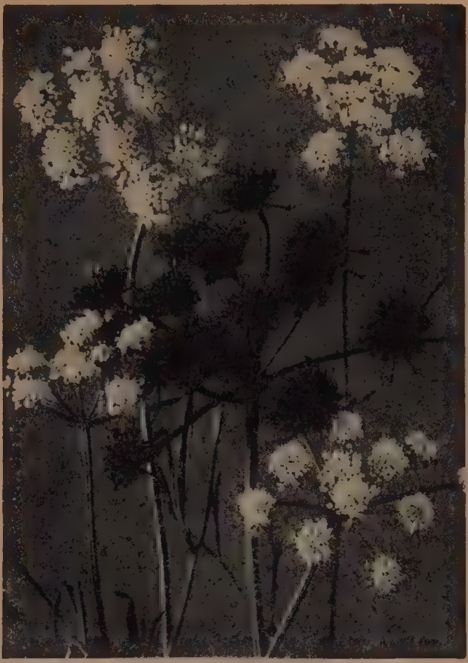
THE CAT-TAIL

The common Cat-tail is a stout and tall water plant with flat sheathing leaves that exceed the stem. Its flower is dark brown and velvety, and it is common in the marshes of North America.



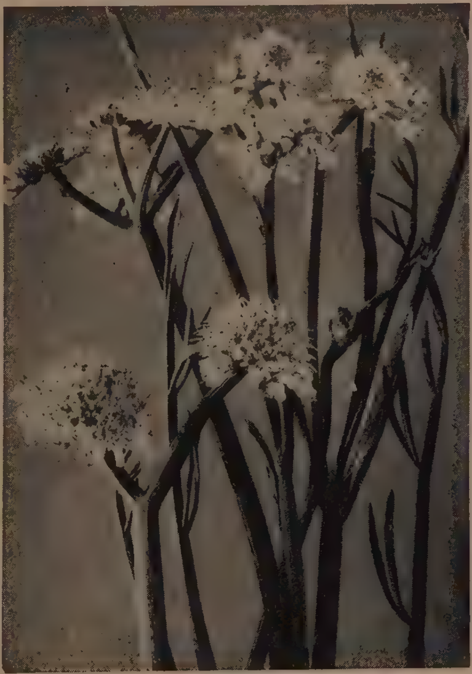
THE WATER AVENS

This plant is quite handsome with its slightly drooping flowers, reddish brown in color. The stems and leaves are hairy. Its name comes from a word meaning "oat," and refers to the oat-like fruits.



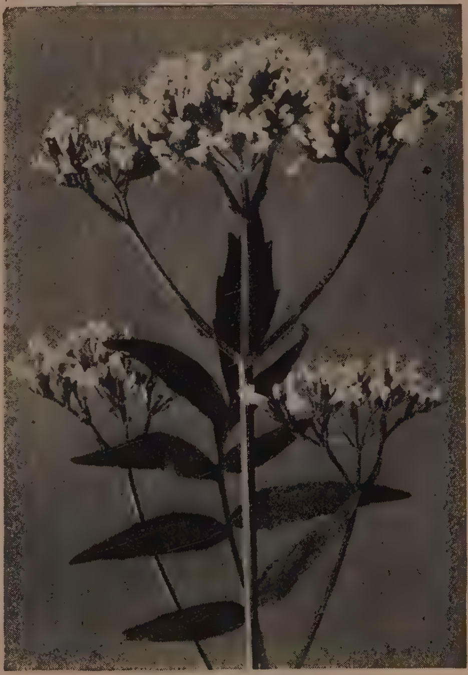
THE SULPHURWORT

The Sulphurwort, or Pepper Saxifrage, is not a streamside plant, although it is often found growing in meadows by European streams. The flowers are a dull yellow, and the fruit is dark brown.



THE WATER DROPWORT OF EUROPE

The Water Dropwort grows on the water, and the lower leaves are submerged, the stems and leafstalks being swollen and hollow. The plant is used as a medicine, but it is harmful if taken wrongly.



THE GREAT VALERIAN

The root of this plant is attractive to cats, and also to rats, owing to its smell. In the United States, in New York and New Jersey, it has escaped from gardens to roadsides.

base of the plant runners are sent in all directions, and at the ends of these, before the winter comes, tubers will be formed, into which all the materials of leaf and stem will be withdrawn, and next year each tuber will form a separate plant.

THE WATER PLANTAIN IS NOT RELATED TO THE FIELD PLANTAIN

Similar in the shape of its flowers, though much smaller, is the Water Plantain. It is no relative of the plantain of the fields, but belongs to the Arrowhead Family. The flower-stem rises three or four feet above the water, is much branched, and bears a large number of flowers similar to those of the arrowhead, but smaller, and of a pale rosy tint. Each flower is complete, with six stamens and twenty pistils.

THE FLOWERING RUSH WHICH GROWS IN EUROPEAN STREAMS

Another member of the Arrowhead Family is called the Flowering Rush, though it is only rush-like so far as its leaves are concerned. These are three or four feet long, straight and slender, but they grow quite erectly. The flower-scape is as long or longer, and the flowers are clustered in an umbel at the top. Petals and sepals are alike of a fine deep rose color, so that the flower appears to be six-petaled. There are six stamens and six pistils, all of a deep red hue. This is a handsome streamside plant of the Old World.

THE GREAT WATER DOCK, A GIANT IN STATURE

Where we discover the arrowhead we may also come across a giant dock, with broad erect leaves two or three feet long, and a great towering panicle of the quaint reddish green flowers. This is the Great Water Dock, a plant of striking aspect.

THE CAT-TAIL, ONE OF THE FEW DARK BROWN FLOWERS

The leaves of the flowering rush may easily be mistaken for those of the Cat-tail, which many people wrongly call bulrush—another plant altogether. If we trace the leaves of the cat-tail downward, we find their lower parts wrapped round the flowering stem, which is not the case with the flowering rush; otherwise they are much alike in shape and size. The stem, an inch thick, rises to a height of six or seven feet, and the upper foot of it is the flower-spike, the greater portion densely crowded with hundreds of tiny dark brown flowers whose sepals and petals are reduced to mere hairs. The mass of flowers has the appearance of a coat of velvet round the spike.

THE GUINEA-HEN FLOWER, OR SNAKE'S-HEAD, NAMED FOR ITS MARKINGS

That frequent, quaint flower of Europe, the checkered purple Fritillary, or Snake's-head, is found only in American gardens, although similar fritillaries occur in Western North America, and their tiny bulbs are greatly prized by the Indians thereabouts as a food. They belong to the Lily Family, but the flowers are shaped much like small tulips, drooping from the top of slender stems, from which small leaves spring. Their color markings gave rise to the name Guinea-hen Flower.

There is no distinction in shape, size or color between the sepals and petals, alluded to as a six-parted perianth. There are six yellow stamens, and the pistil ends in three stigmas.

THE LOOSESTRIFE IS ONE OF THE TALL STREAM FLOWERS

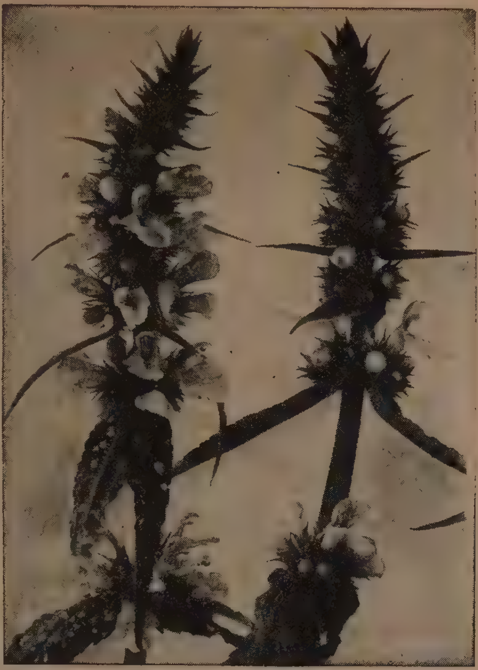
Returning to our stream, we shall perhaps find Purple Loosestrife, which is also found in Europe, along its bank. It grows to a height of three or four feet, with an angled stem, clothed in lance-shaped leaves, which are usually in pairs, and more or less erect. The upper part of the stem bears whorls of six-petaled flowers red-purple in color. There are twelve stamens and a slender pistil; and in this plant we shall find differences in the length of the stamens similar to those found in the primrose.

THE MEADOW-SWEET, A MEMBER OF THE ROSE FAMILY

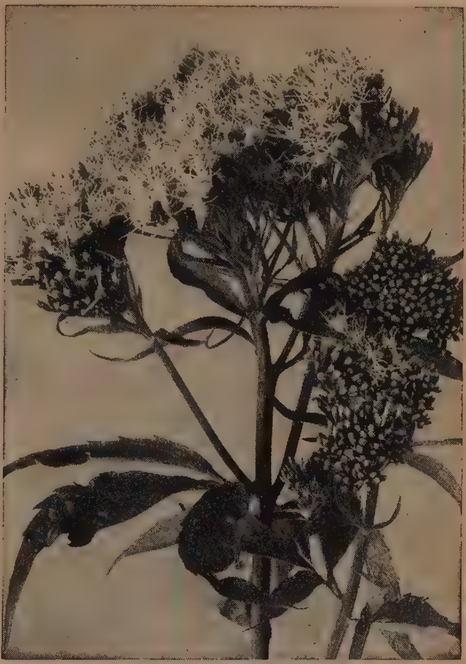
The most plentiful of the streamside summer flowers in Europe is the Meadow-sweet, a plant that, judging by the light, foam-like masses of small white flowers, we should not at first sight take to be one of the Rose Family. But if we look at the beautiful divided leaves, we shall remember that they are much like those of the agrimony and silverweed. The American Meadow-sweets have flesh-pink and white flowers, with prominent pink-red stamens.

THE WATER AVENS ARE WIDELY DISTRIBUTED IN AMERICA

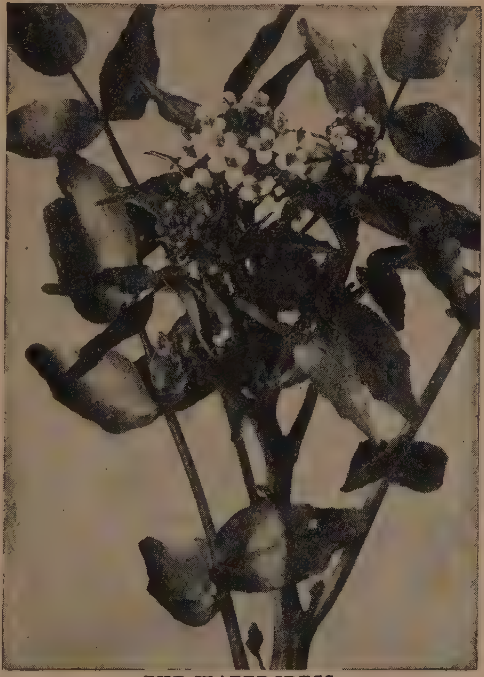
Another member of the Rose Family, though not so plentiful as several others, is the Water Avens, closely related to



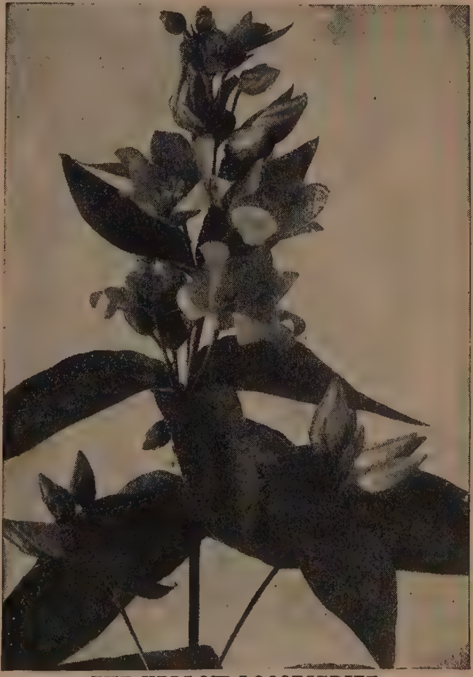
THE MARSH WOUNDWORT
This plant, with its erect stem and flowers of a dull light red growing in a long spike, has a strong odor, though less powerful than that of its relative the hedge woundwort. It is common in marshes.



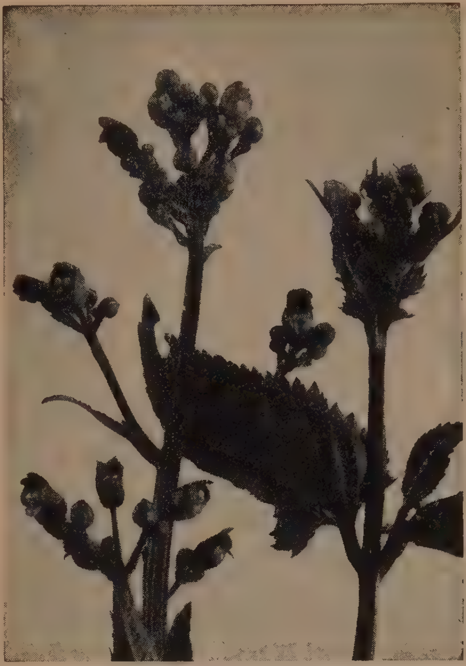
THE HEMP AGRIMONY
The flowers of the Hemp Agrimony, which grows in most places in European countries, are much visited by butterflies. They are dull lilac in color, and the plant has an attractive appearance when in bloom.



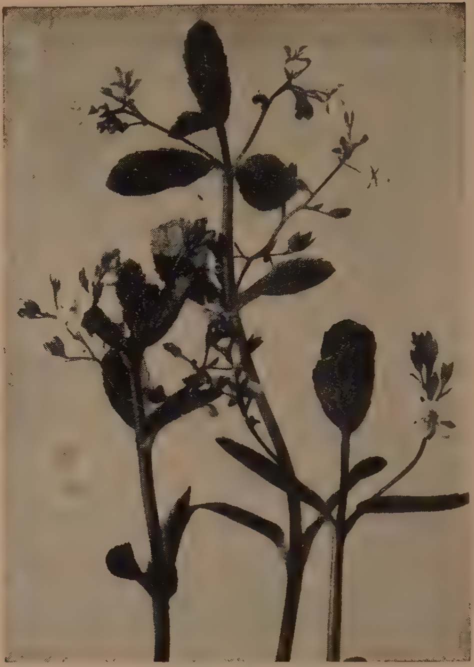
THE WATERCRESS
The Watercress belongs to the Cabbage Family. We all know it as used in salad, but its little white flowers are less known to townsfolk. Introduced into New Zealand, it often stops the streams.



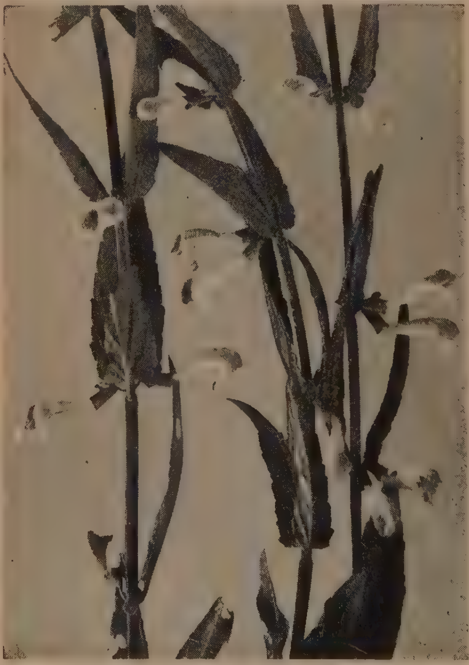
THE YELLOW LOOSESTRIFE
Although the names are similar, this plant is not related to the purple loosestrife, which we see on page 5873. This belongs to the Primrose Family, and the fine yellow flowers are very conspicuous.



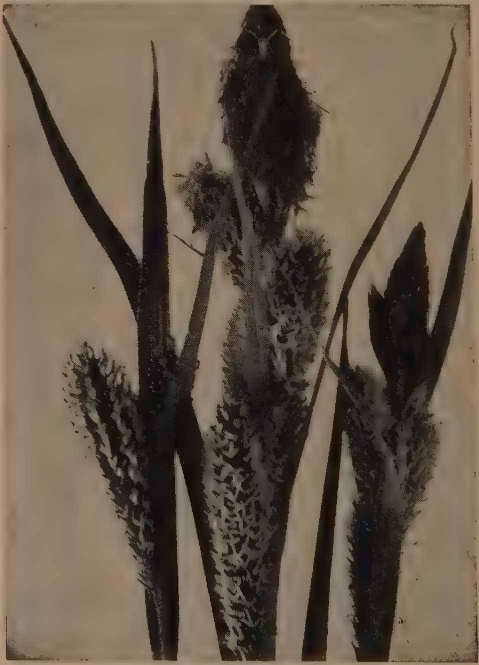
THE WATER FIGWORT
European anglers know the Water Figwort only too well, for their lines become entangled in the seed-vessels of the plant as it grows by the streamside. The round flowers are purplish chocolate.



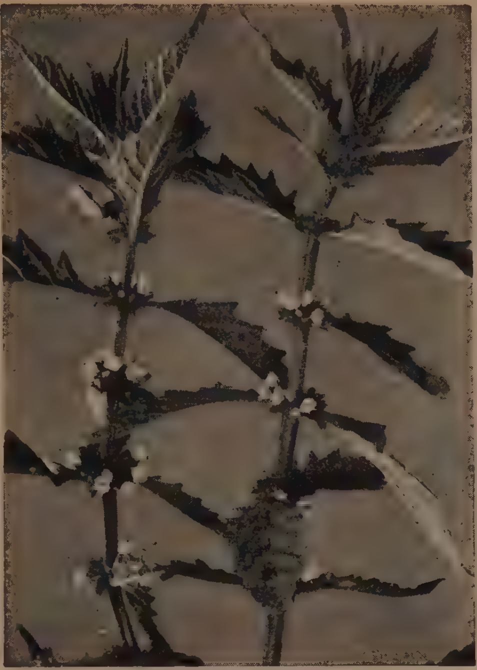
THE BROOKLIME
This is another member of the Figwort Family, and is often found growing with the watercress and water parsnip. It was formerly used for gout. The flower is lavender-blue striped with violet.



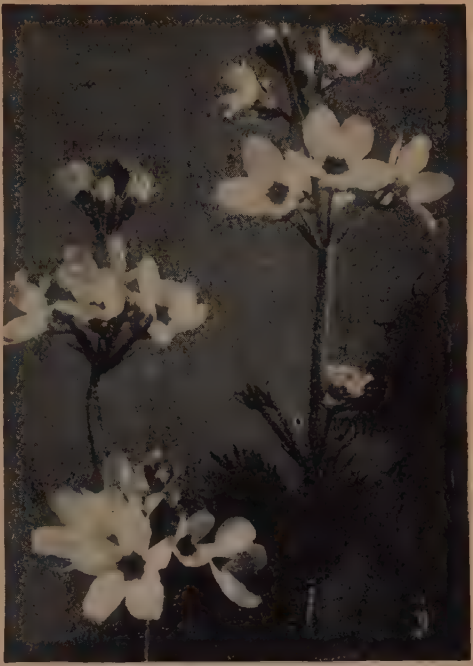
THE GREATER SKULL-CAP
The Skull-cap, with bell-shaped flowers of bright blue, growing in a marshy spot, is always attractive. The leaves are lance-shaped with a toothed edge, and the plant often grows to eighteen inches.



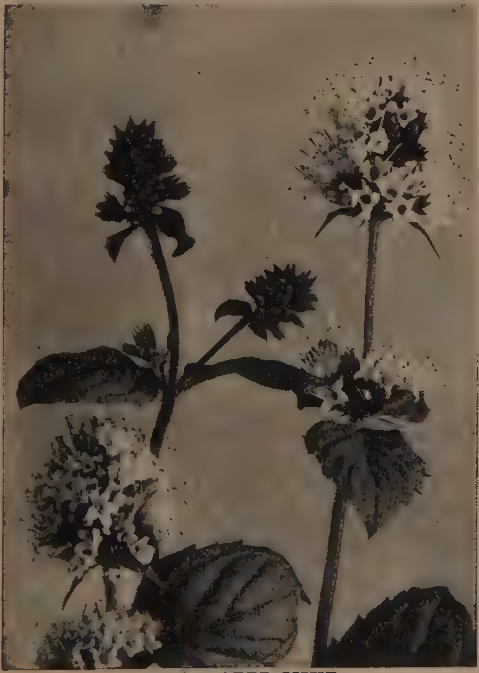
THE MARSH CAREX
This is one of the sedges, which have grass-like leaves and are found growing in various situations, some in rivers and marshes, others in bogs, and others by the seashore. They need damp situations.



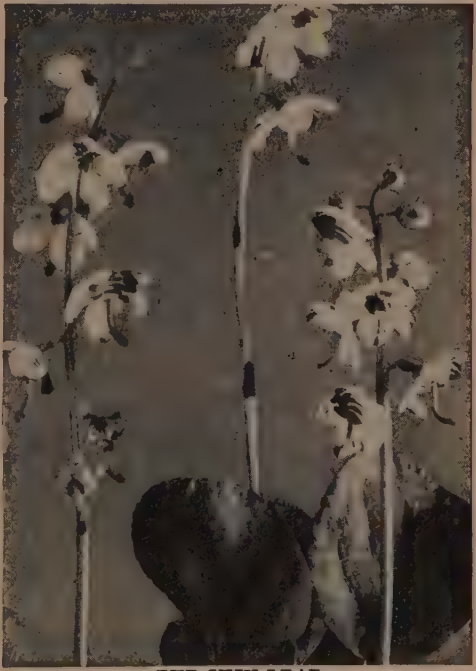
THE GIPSYWORT
The flowers of the Gipsywort, which are white, dotted with red, are not attractive. It is the leaves, the most conspicuous part of the plant, that draw our attention to it as it grows by water.



THE WATER VIOLET
The large lilac flowers of this Water Violet, each with a yellow centre, are among the most attractive of the Old World blossoms. An American variety has white flowers. It grows near seacoasts.



THE WATER MINT
Although it is not common, some of us know the pale purple flowers of the Water Mint, which grows in swamps and roadside ditches. The stems are covered with downy hairs which point downward.



THE SHIN LEAF
This flower once belonged to the Heath Family. It now has a family of its own, Pyrola, from the Latin, meaning "little pear," because the leaves are like those of a pear tree.

the common avens, or herb-bennet, of European roadsides. Its leaves are much like those of herb-bennet, which are really on a similar plan of structure to those of meadow-sweet, but with coarser lobes; but the flowers are larger—an inch and a half across—with purple sepals and yellow petals.

THE DROPWORTS INCLUDE THE SULPHURWORTS AND WATER DROPWORTS

There are several of the umbel-bearers known as Dropworts, including in Europe the Sulphurwort, with gray-green, pipe-like stems, and a leaf that is little more than a long pipe-like midrib with a few narrow leaflets on each side. A much larger species is the Hemlock Water Dropwort, which has broader leaves of a more parsley-like form, and small umbels of flowers more widely spread, because their foot-stalks are longer. This is a very poisonous and dangerous plant.

This hemlock-leaved water dropwort must not be confused with the water hemlock, or cowbane, one of the same family, with a similar reputation for poisonous properties. It has a stout rootstock, a tall furrowed stem and large wedge-shaped leaves that are much divided. Although the white flowers are very small, they are massed in large umbels, and the plant as a whole is attractive and imposing.

THE HEMP AGRIMONY IS A RELATIVE OF THE JOE-PYE WEED

A European plant that may appear to have some relationship to these umbel-bearers is the Hemp Agrimony, but it is really a composite. Its flower-heads contain only five or six pale purple tubular florets, instead of the two or three hundred to be found in a head of daisy or dandelion; and these heads form small clusters, which are in turn massed into great clusters at the top of the four-foot stems. The leaves consist of three or five lance-shaped drooping leaflets which are somewhat like the leaves of hemp, while the complete leaf has a resemblance to an elder leaf. It is a close relative of the American boneset and Joe-Pye weed.

THE WATERCRESS WHICH IS USED FOR SALADS

Here and there we come upon a stretch of streamside where, for some reason, no tall plants grow; and here we shall probably find the Watercress, which most of us can recognize by its dark, brownish leaves, which are broken up into roundish leaflets arranged in pairs along the midrib, and the small white flowers are clustered. A glance at the four petals and the seed-vessels will show us that this is a cross-bearer.

THE FORGET-ME-NOT, THAT SEEMS BORROWED FROM THE SKY

With the watercress will probably be the Forget-me-not, with its strangely curled spray of sky-blue flowers, each with a little yellow round the mouth of the flower-tube. It belongs to the same family as the beautiful viper's bugloss. Another relative is the Comfrey, with stems that are from one to two and a half feet high, broad lance-shaped bristly leaves, and large tubular flowers of pale violet color, which hang with their mouths downward.

THE YELLOW LOOSESTRIFE OF THE PRIMROSE FAMILY

There are so many flowers along the streamside that it is impossible to mention them all. There is the tall-growing Yellow Loosestrife, no relative of the purple loosestrife, but a member of the Primrose Family. It has a stem one to two feet in height, with broad lance-shaped leaves and pyramids of bright yellow bell-shaped flowers, though they do not hang as bells do.

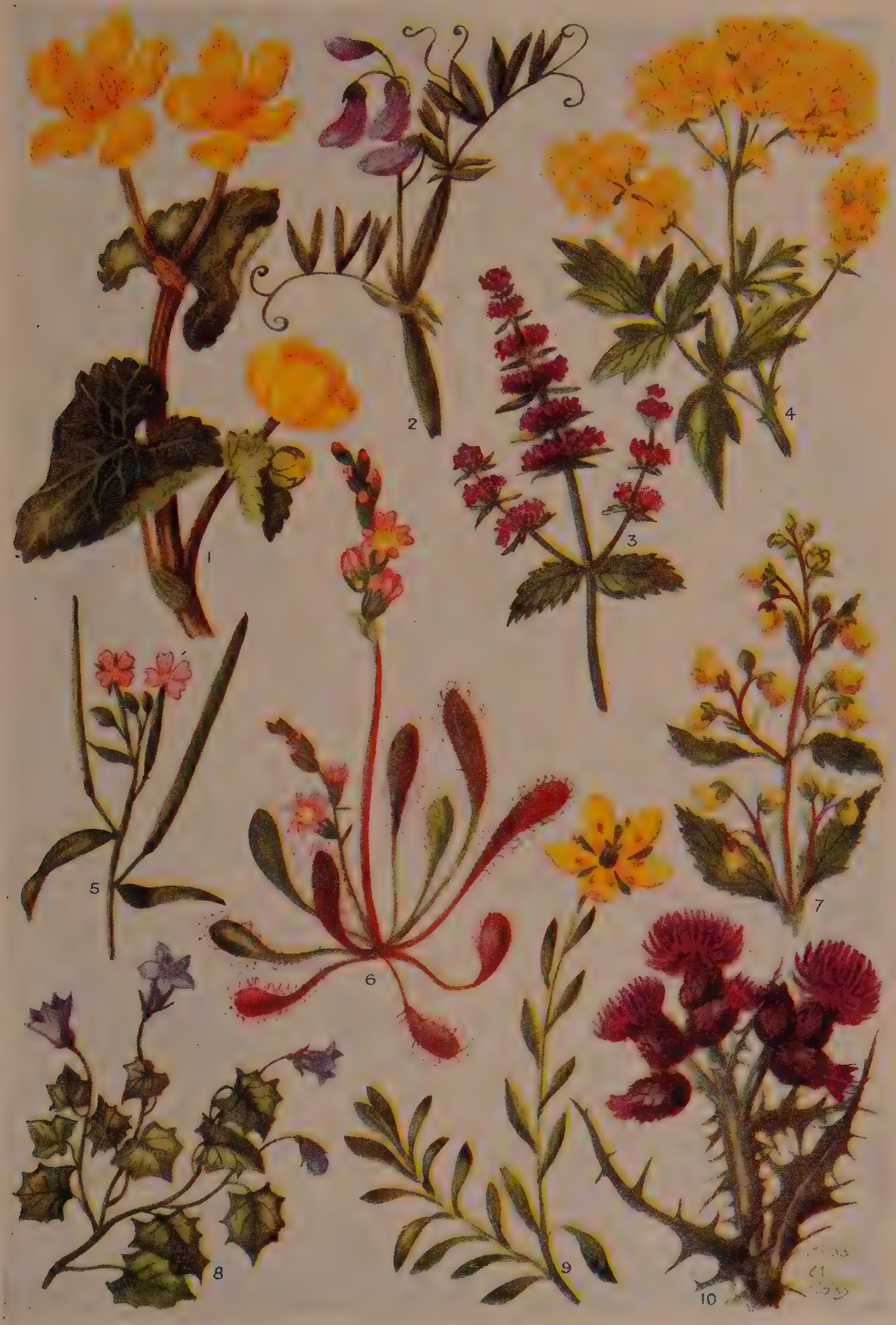
Another tall plant is the Great, or Cat's, Valerian, sometimes found in gardens, whose root-leaves are divided into pairs of lance-shaped leaflets, and whose small pale pink flowers are clustered.

Then there is the Figwort of Europe, with thick square stems six feet high, large oblong leaves, and green and brown flowers shaped like a coal-scuttle, because that shape best suits the heads of wasps, who have a liking for its color and unpleasant smell.

The Labiate, or Mint, Family is represented along the streamside by several kinds of mint, which remind us of their presence by their strong, sweet odor; and by gipsywort, skull-cap and marsh woundwort. Gipsywort has oblong leaves in pairs on its square stem, and whorls of tiny bluish white flowers dotted with purple. Skull-cap, with a similar arrangement of stem and leaves, has its large blue flowers in one-sided pairs. Marsh woundwort is a plant much like hedge woundwort, but shorter, with narrower leaves and paler flowers.

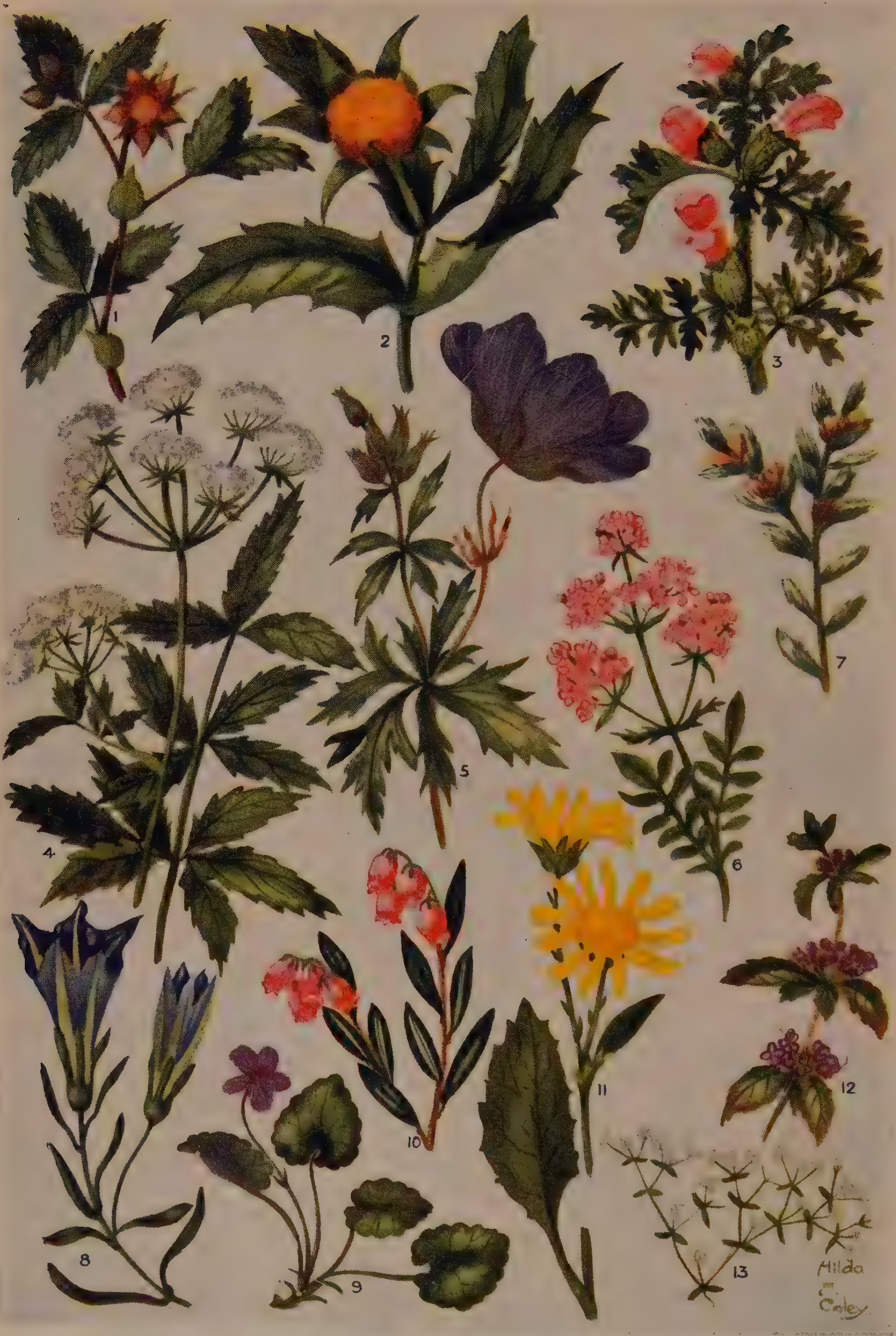
THE NEXT STORY OF PLANT LIFE IS ON PAGE 6123.

FLOWERS OF THE MARSHES



1. Marsh Marigold. 2. Blue Marsh Vetchling. 3. Horse Mint. 4. Yellow Meadow Rue (E.). 5. Marsh Willow-herb. 6. Great Sundew. 7. Knotted Figwort. 8. Ivy-leaved Bellflower (E.). 9. Yellow Saxifrage. 10. Plume Thistle.

Flowers marked (E.) are European and are not generally found in America.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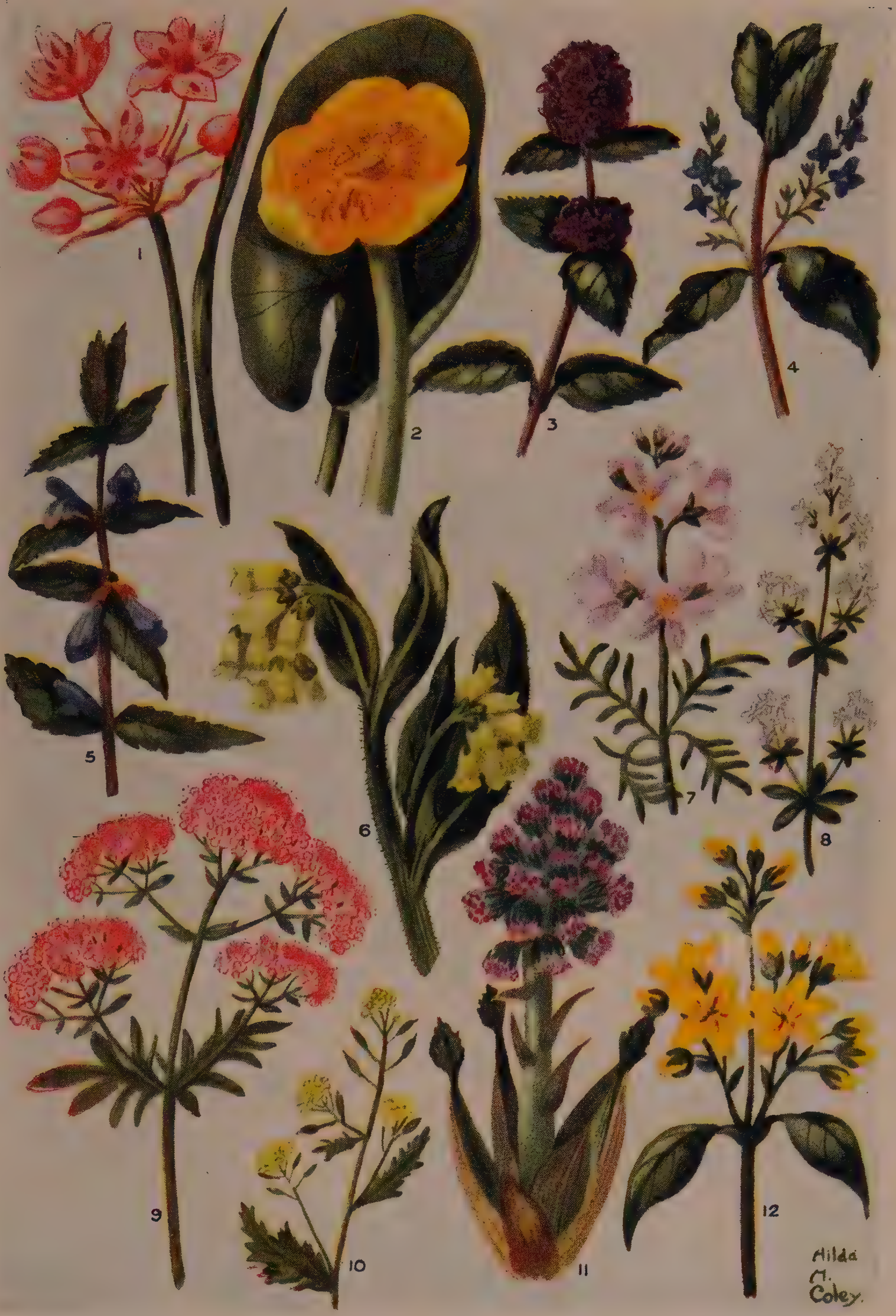
C.
Coley

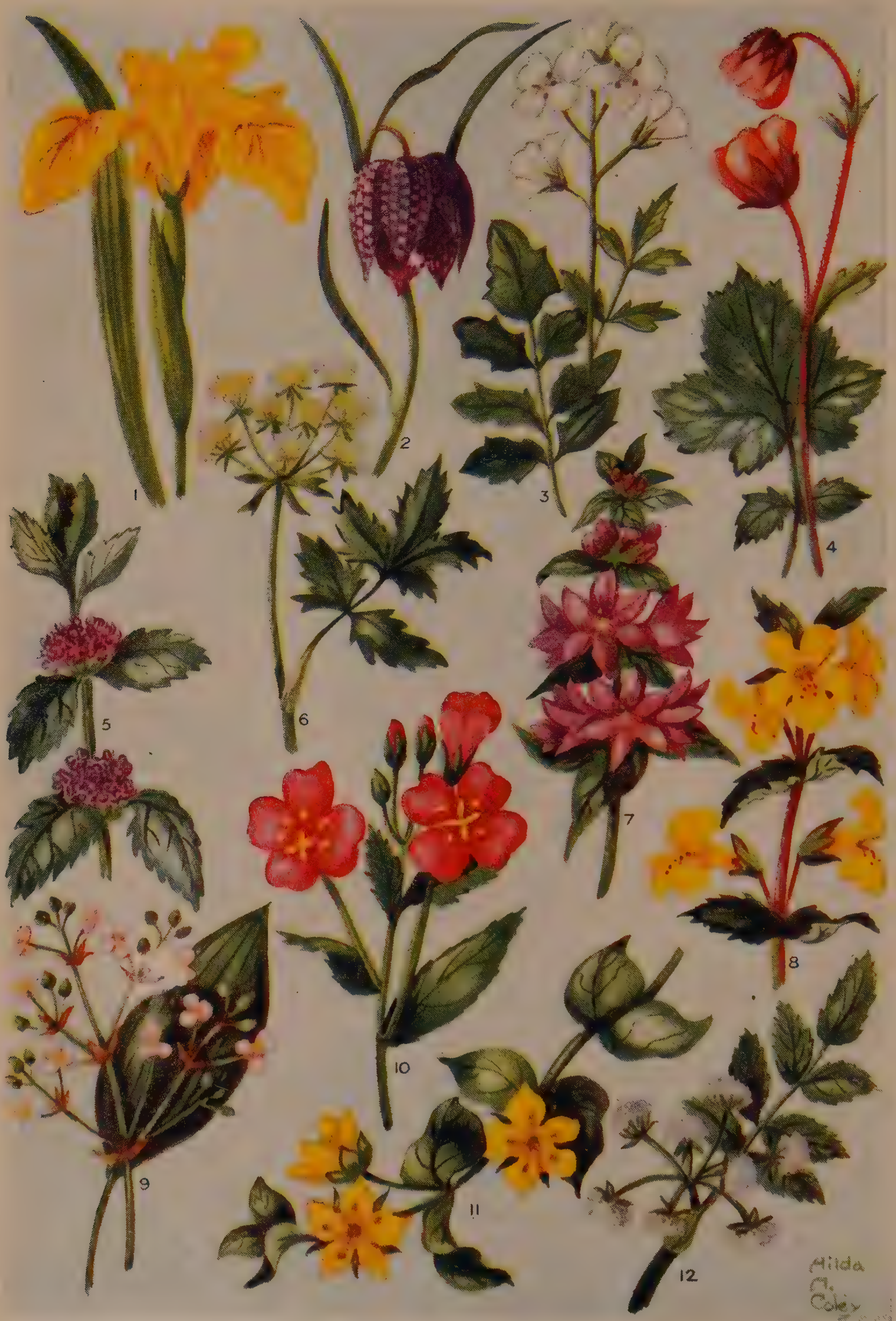
1. Marsh Cinquefoil. 2. Swamp Beggar-ticks. 3. Marsh Red-rattle (E.). 4. Water Hemlock. 5. Meadow Cranesbill. 6. Swamp Valerian. 7. Marsh Cudweed (E.). 8. Marsh Gentian (E.). 9. Marsh Violet. 10. Marsh Andromeda. 11. Marsh Ragwort. 12. Pennyroyal (E.). 13. Flaxseed (E.).

FLOWERS OF THE STREAM



1. Flowering Rush (E.). 2. Yellow Water Lily. 3. Water Mint. 4. Brooklime. 5. Greater Skullcap. 6. Common Comfrey. 7. Water Violet (E.). 8. Water Bedstraw. 9. Great Valerian. 10. Marsh Yellow Cress. 11. Common Butterbur. 12. Yellow Loosestrife.

Flowers marked (E.) are European and are not generally found in America.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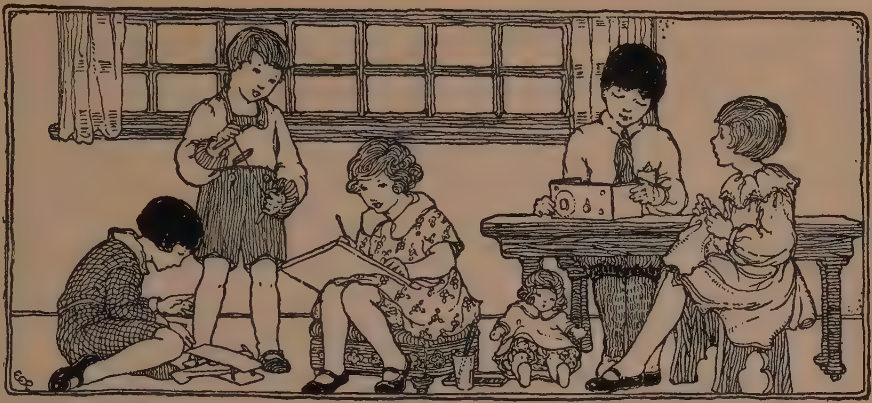
1. Yellow Iris. 2. Snake's Head. 3. Large-flowered Bitter Cress. 4. Water Avens. 5. Marsh Whorled Mint. 6. Water Parsnip. 7. Purple Loosestrife. 8. Yellow Monkey Flower. 9. Water-plantain. 10. Willow-herb. 11. Moneywort. 12. Procumbent Marshwort (E.).



THE GAME OF FIELD HOCKEY

HOCKEY is a splendid winter game for both boys and girls. It is played on a field marked out as seen in the diagram, although the field may be much smaller than that shown. The game lasts about seventy minutes, the players changing over at half-time.

In the centre of each goal-line stands the goal. In front of each goal is the striking circle and no goal can be scored unless the ball is hit through the posts from inside this circle. The lines themselves count as part of the striking circle.

A hockey ball is like a cricket ball and is painted white, or made of white leather. A hockey stick must be made of wood, and must have a flat surface on its left side only, and must not weigh more than 28 ounces.

For a match each team consists of eleven players. The object of the game is for one team to put the ball through its opponents' goal as often as possible, and to prevent them from scoring. A team is generally divided into five forwards, three half-backs, two backs and a goal-keeper.

The forwards must be swift runners, able to dribble and dodge and shoot and to hit a ball from a pass without first stopping it dead. The half-backs must help the attack by constantly feeding their forwards with the ball.

The backs must be strong and plucky players, able to hit hard and straight and to stop hard hits and tackle rushes.

The goal-keeper is the last line of defense, whose duty is to prevent the ball from passing between the posts and to send it away from the neighborhood of the goal. He may kick the ball when he is inside his own striking circle. If there is no goal-keeper, one other player may be chosen who will have the right to kick the ball.

The game is started by the two rival centre-forwards "bullying off" in the middle of the centre-line, while the rest of the players must stand in position, as shown in the diagram. To bully off, each of the two centre-forwards, both standing squarely opposite each other and facing the side-lines, must first strike the ground on his own side of the ball and then his opponent's stick over the ball, three times alternately. Either may then strike the ball independently, thus putting it into play. This central bully also takes place after half-time and whenever a goal has been scored. A goal is scored when the ball passes entirely over the part of the goal-line between the posts, after being hit by, or having glanced off, the stick of an attacker who is inside the striking circle.

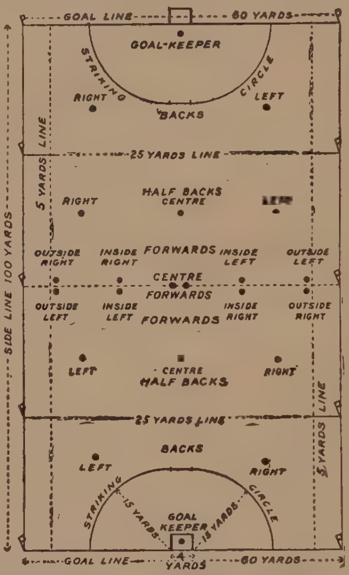
The ball may be stopped when it is in play, but immediately it must be let fall straight down to the ground. It may be stopped dead with the feet or with any part of the body. It is against the rules to raise any part of the stick above the shoulder while striking the ball; to touch the ball with the back of the stick; to fence or hook sticks with any opponent who is not within striking distance of the ball; to strike or hook an opponent's person; to charge, kick, collar or trip up an opponent; to obstruct an opponent by running between him and the ball; to touch him when running across him from the left, unless we touch the ball first, to pick up, carry or kick the ball. The following are the penalties for breaking any of the above rules.

If the offense is committed by either side outside the striking circle, or by the attacking side within their opponents' striking circle, a free hit is given. While this is being taken none of the offender's side is allowed within 5 yards of the ball, and the player who takes the free hit may not play the ball again until it has been touched by another player; if he does, a free hit is given to the other side. If the offense is committed by the defending side within their own striking circle, a penalty corner is given. Flagrant breach of the rules in the circle is punished with a penalty bully. If the rules for the penalty bully are broken, the penalty bully is taken over again.

When a player sends the ball right over the side-line, it must be rolled in by one of the opposite side. The roller-in must stand at the point where the ball crossed the side-line and, with his stick and both feet outside the line, roll the ball in any direction along the ground, otherwise it is a foul throw. The moment the ball leaves the hand it is in play, but until then all other players must stand at least 5 yards from the side-line.

When a player of one team is rolling in or hitting the ball any player of the same team who is at that moment nearer the opponents' goal-line than the striker or roller-in is off-side, if there are not at least three opponents nearer their own goal than he is. But we cannot be off-side in our own half of the ground.

If the ball is unintentionally sent behind the goal-line by one of the defending team who is within the 25-yard line, the umpire must give a corner hit to the attacking team; if the ball is deliberately hit behind the line by a defender in the circle, a penalty corner is given.



Hockey-field and position of players.

For an ordinary corner all the members of the defending team must stand behind their own goal-line; the attacking team stand outside the striking circle in the field of play. One of the attacking team then takes a hit from any point on the goal-line or side-line within 3 yards of the nearest corner flag. No player may stand within 5 yards of the striker while the corner hit is being taken, and no goal can be scored from a corner hit unless the ball has first either been stopped by an attacker, or touched the stick or the person of one of the defending side. The player who takes the corner hit cannot touch the ball again until it has been hit by another player. When a penalty corner has been awarded, one of the attacking team takes a hit from any part of the goal-line not less than 10 yards from the nearest goal-post. All other players stand as for an ordinary corner. A move means another hit.

A penalty bully is played on the spot where the rule was broken, by the player who has broken the rule and some member of the opposing team. All other players must keep beyond the nearer 25-yard line in the field of play.

If during a penalty bully either player sends the ball over the goal-line between the posts, it counts a goal to the attackers. If the offender sends the ball behind any part of his own goal-line outside the goal-posts, the bully must be taken again. If either player sends the ball outside the striking circle, the game is restarted by an ordinary bully on the centre of the nearest 25-yard line; the same is also done if, in the penalty bully, the attacker happens to send the ball over the goal-line outside the goal-posts.

Hockey is a very old game known to the peoples of Europe, of Asia and of the Americas. Its name is thought to have come from the French word *hoquet*, meaning "shepherd's crook," because of the hooked stick used. The ancient Romans played a game somewhat like our present-day hockey. In Scotland and Ireland the game was played usually on the hard sandy seashore. The Indians in this country were very familiar with hockey, which they played on the grass in summer and on the ice in winter.

A PENKNIFE AS A COMPASS

WE may want to draw circles of various sizes when there are no compasses handy, but if we have a penknife we can easily turn it into a compass.

All we have to do is to open the two blades of the penknife, one at each end, fix the point of the small blade into a piece of black lead pencil, and then, using the long blade as a centre, operate the knife in the same way as an ordinary compass. The blades can be opened or closed to any angle, to make circles of greater or less diameter.

One or two things have to be remembered in order to insure success with the penknife compass. It is, of course, important that the blades should not be loose in the handle. Then the knife must not be so new that the springs work with great force and snap up at the least touch; in that case we could not, of course, regulate the size of our circles as required.

Also, the pencil, which must not be too long, must be fixed firmly to the small blade so as to allow of no wobbling when the circles are being drawn. If the knife is sharp, we must be careful not to cut ourselves when fastening on the pencil and regulating the angles of the blades.

SOLUTIONS OF THE BOTANICAL PUZZLES

IN the botanical puzzle game on page 5771, descriptions were given of six different plants, and we had to name these plants of such varied characters, uses and appearance from the descriptions given. The correct solutions are as follows: 1, Bladder-wrack; 2, Mushroom; 3, Bitter-sweet; 4, Hyacinth; 5, Wheat; 6, Coconut-palm.

RECENT STAMPS FOR YOUR COLLECTION

SEVERAL suggestions for collecting and mounting early and recent issues of stamps were given on page 5111. Because of the many new domestic and foreign stamps which have appeared recently, it is assumed that you may wish to add these as a part of your 1925 collection. In order that the various new stamps may be understood, brief explanations of each issue are given.

Boys in the United States are certain to have more interest in stamps distributed at Washington than in those issued by foreign countries. Much interest has been given by all amateur stamp-collectors to the recent issue by the United States Government of ten new stamps and one new stamped envelope.

A design symbolical of Dawn of Liberty, showing the battle of Lexington, is the subject of a 2-cent stamp of the series that was issued at Washington in April, 1925. Another symbolical design of the Minute Men at Concord is depicted on the 5-cent value, blue in color. On the 1-cent green stamp is pictured George Washington taking command of the Yankee troops under the historic elm that stood in Cambridge until recently destroyed because of age. These important commemoratives are transverse oblong in shape.

Then, too, Congress enacted a postal bill granting temporary increases in the wages of postal employees. In order to raise the necessary revenue to meet this new federal expenditure, the Post Office Department was authorized to advance the postage rates on certain classes of mail. Thus the printing of new stamps became necessary. The new rate on third-class mail was fixed at 1½ cents an ounce, and a stamp of that denomination, light brown in color, carries the same portrait of the late President Harding that appeared on the Harding 2-cent memorial commemorative issued after his death. The new 1½-cent stamped envelope has the current profile of Washington as the design. Also a ½-cent postage stamp was issued for the first time on April 1, 1925. It carries the portrait of Nathan Hale. Two new special-delivery stamps were required, in values of 15 and 20 cents. The 15-cent stamp, canary-yellow in color, has the same design as appears on the current 10-cent ultramarine special-delivery stamp. On the new 20-cent special-delivery stamp is pictured a motor mail-wagon standing in front of the Washington City Post Office. The other stamp made necessary is a 25-cent special-handling stamp, plain blue in color, which will secure for parcels the same expeditious handling, transportation and delivery accorded to first-class mail.

In addition to these stamps the amateur collector will be interested in the following issues of United States stamps to meet the increase in postal rates on certain classes of mail: a ½-cent value is being added to the postage-due prices. The ½-cent stamp, with Nathan Hale's portrait, added to the regular series, has also been issued imperforate. The 1½-cent stamp, with Warren G. Harding's profile, added to the regular series, has appeared in four varieties: perforated 11, printed from flat plates; perforated 10, printed on the rotary press; perforated 10, vertically, in coils from the rotary press, and without perforation. The 1½-cent stamped envelope, bearing Washington's picture, has appeared in three colors—that is, the circular die, in brown, varies on white, blue and manila envelopes. A 1½-cent manila wrapper has been issued, the die, with Washington's portrait, being in brown.

FOREIGN STAMPS

Brazil. A commemorative 1,000-rei claret stamp, with a portrait of Ruy Barbosa, has been issued. Barbosa was a journalist whose oratory and eloquence contributed to Brazilian revolutionary activities that culminated in the adoption of the republican form of government about thirty-five years ago. Only 200,000 copies of this stamp were printed—a small supply to meet the philatelist's needs!

Bulgaria. A few years ago a large quantity of postage-due stamps was printed in connection with an increase in postal rates. Before they were issued, however, the Government decided to destroy all letters insufficiently stamped. Thus the postal authorities had left on their hands unissued postage-due stamps in values 5, 10, 20 and 30 stotinki. These have now been converted into regular postage stamps by surcharging them with new values.

China. A nearly parallel situation prevails in China. In 1923 the postal authorities announced an increase in the postal rate to 4 cents, as compared with 3 cents. The public protested and the advance was not put through. But meanwhile a 4-cent gray stamp, with the familiar native junk as the design, had been printed in large quantities. This appears now as a provisional 3-cent stamp overprinted in red with the lower value.

Czecho-Slovakia. The president of this republic, Dr. Masaryk, who celebrated his seventy-fifth birthday on March 7, 1925, is an enthusiastic stamp-collector. In honor of his birthday a series of stamps bearing his portrait has appeared in values and colors of: 40 haleru, orange-brown; 50 haleru, yellow-green; 60 haleru, purple; 1 koruna, carmine; 2 koruna, blue; 3 koruna, sepia; and 5 koruna, blue-green. Another hero, John Ziska, who was a Bohemian general and Hussite leader, won such renown through successes with his army that his name ranks high in Czecho-Slovakian annals. A new series of stamps issued in that country carries Ziska's portrait. This set commemorates the four-hundredth anniversary of the patriot's death, which took place during a plague in the midst of one of his military campaigns.

Dominican Republic. A series of eight denominations—½, 1, 2, 5, 10, 20 and 50 centavos and 1 peso—were in use from February 27 to July 12, 1925, for domestic postage exclusively. Consequently the employment of the island's ordinary stamps was forbidden during that period except on mail to foreign countries. The new stamps are said to commemorate the evacuation of the republic's territory by United States troops. With the money obtained through the sale of these stamps the Government purposes to build a postal and telegraph building at Santo Domingo.

France. In connection with the International Philatelic Exhibition held in Paris in May, 1925, a 5-franc carmine stamp of the design of the 1876 issue was distributed and was sold exclusively at the exhibition.

Hungary. Maurus Jókai was the author of hundreds of historical books descriptive of his native country's life and scenery, and many of his works have been translated into English. Jókai, who died in 1904, was born a century ago, in 1825. Stamps which Hungary has issued bear his portrait and the dates 1825 and 1925, together with his name expressed in Hungarian, Jókai Mor. Values and colors of these stamps are: 1,000 korona, green and sepia; 2,000 korona, brown and sepia; and 2,500 korona, blue and sepia. A stamp valued at 1,000 korona seems very expensive, but it must be remembered that since the World War Hungarian money has dropped enormously in value.

Holy Mecca. New stamps can usually be expected when a monarch of a foreign country abdicates his throne as a result of political or military controversy. King Hussein abdicated his throne in October, 1924, after warring Wahabi tribesmen had invaded his land, Hedjaz. King Ali succeeded King Hussein and about three months later, in January, 1925, the expected stamps materialized. They comprise seven values of Hedjaz's locally printed 1922 series surcharged.

Indo-China. The inscription "Indo-Chine" on the stamps of this French colony is being altered to "Indochine."

Nicaragua. Francisco Fernandez de Córdoba founded two of the chief cities in Nicaragua—León, capital of the department of León; and Granada, capital of the department of Granada. And so the wording "Fundador de León y de Granada" is appropriately the inscription which appears under Córdoba's portrait on Nicaraguan stamps, which, issued early in 1925, are really a 1924 series. Each stamp bears the dates 1524 and 1924. The set comprises the following values and colors: 1 centavo, green; 2 centavos, carmine; 3 centavos, olive-green; 5 centavos, blue; 6 centavos, reddish brown; and 10 centavos, brown.

Syria and Lebanon. Pictorials have been issued for these two territories under French mandate. Each series contains eighteen values, including postage-due stamps ranging from 10 paras to 25 piastres. Views shown on the Syrian stamps are as follows: Hama on the 10 paras, violet; Mehreb on the 25 paras, bronze; Alexandretta on the 50 paras, green; Rauca on the 75 paras, dark brown; Damascus on the 1 piastre 25 paras, red; Latakia, famous for its tobacco, on the 1 piastre 25 paras, green; Palmyra on the 2 piastres, brown, and 25 piastres, blue; Rabat-Yamour on the 2 piastres 50 paras, blue-green; the Bridge of Daphne on the 3 piastres, brown; Aleppo on the 5 piastres, lilac, and 10 piastres, purple-brown; and various other views on the postage-due stamps. On the pictorials of Lebanon are shown scenes of Beirut, Tripoli, Beteddine, Baalbeck, Mouktara, Tyre, Zahle, Hama, Saïda and Delport. Many of these names are probably strange to you, but they are familiar to boys in Syria and Lebanon, and you will recognize some of them in connection with your knowledge of the Bible.

AIR-MAIL STAMPS

The development of the airplane as a medium for expediting the forward movement of mails has resulted in the issuing of twenty-three more varieties of air-mail stamps—in Albania, Bolivia, Egypt and Siam. Air-mail stamps are now in use in the United States.

Albania's set comprises transverse oblong stamps with a common design—a town with a background of mountains, and above them an airplane in flight and an eagle on the wing. The inscription includes "Posta Aerore." Denominations and colors are: 5 centimes, green; 10 centimes, red; 20 centimes, blue; 50 centimes, dark green; 1 franc, violet and black; 2 francs, olive and violet; and 3 francs, orange and dark green. The values (centimes and francs) are in the terms of Albania's new gold standard of currency.

Bolivia's set was issued to commemorate the opening of the republic's National School of Aviation, and the stamps carry two designs, each being an airplane at rest on the ground—significant of the fact that the youths attending the school have not yet become full-fledged fliers. Values and colors are: 10 centavos, vermilion and black; 15 centavos, carmine and black; 25 centavos, dark blue and black; 50 centavos, orange and black; 1 bolivar, red-brown and black; 2 bolivars, brown-black; and 5 bolivars, violet.

Egypt's initial air-mail stamp is 27 millièmes in value, and "Aerial Post" and "Kingdom of Egypt" are the inscriptions. An airplane is the design.

Siam has produced some of the quaintest air-mail stamps in the history of stamp-collecting. The uniform design on this set of oblong stamps is the garuda, a mythical king of birds, half man and half eagle, which was the steed of the Hindu god called Vishnu. The garuda has appeared on Siam's stamps before. On these air-mail stamps it is shown resting against Siam's coat-of-arms, but is in flight with arms and wings outspread. "Siam Air-Mail" is inscribed on the stamps in both English and native script. Values and colors of the first four denominations to appear are: 3 satangs, brown; 5 satangs, green; 15 satangs, carmine; and 25 satangs, indigo. Denominations of 2, 10, 50 satangs and 1 baht are promised for later distribution.

Although you may not be able to secure all of these stamps, it is quite possible that acquaintances here and abroad can assist you in securing some of these if you make your desires known to them.

Stamp-collecting has been a popular hobby ever since stamps were first used. Of course, in the early days the varieties were limited in number, but they were more difficult to collect because transportation from country to country was so poor. To-day, when it is so easy to communicate with all countries of the world, stamp-collectors form clubs that help members to fill their albums. There are about 63,000 varieties of stamps known at present, but it is hardly likely that any collector will have them all. In two years over 4,000 new issues were printed by different countries. To keep up with the changing issues will be interesting always. To get issues as they come out is easier than finding them afterward.

MAKING A COLLECTION OF WOODS

A GREAT deal of amusement and instruction is to be obtained from a collection of different kinds of woods, and such a collection it is within the power of each one of us to make. The woods of the different trees are wonderfully varied in weight and solidity and marking, and by preparing sections of these we have a collection that is pleasing to the eye and that need take up very little room in the house.

Sections of wood for our collection should be made across the trunk, and they should be thin enough for the light to pass through. With a little practice such sections can readily be sawed. A good saw is necessary, and if the wood be dry it should be dampened, so that the different parts of the material may hold together and a smooth section be provided.

WHERE TO OBTAIN SPECIMENS

Specimens for our collection may be obtained in different ways. Of course if we live in the country, especially in the neighborhood of woods where trees are being felled, we may get permission to take sections from the trees. But it is astonishing how many really excellent and serviceable specimens are to be obtained for nothing at all in sawmills, lumber yards, cabinet-making establishments, carpenters' shops, and so on. In fact, almost any place where different kinds of wood are used is sure to provide us with some specimens. While it is especially to be desired that our sections should be across the trunk of the tree, if this is difficult or impossible sections cut lengthwise are by no means to be despised.

HOW TO MOUNT THE WOODS

Our specimens should be as complete as possible—that is, the sections should be as large as we can obtain and conveniently store; but great size is not essential, and quite small sections a few inches square are quite large enough to show the characteristics and markings of the different woods. It is not necessary to mount the specimens, although, of course, the collection is much more presentable if every piece of wood is properly mounted.

It is necessary that we should be able to hold the wood up to the light and see its texture; but this may be easily done if we gum or glue the wood down upon a sheet of thick paper or card that has a neat oval opening cut in it, just like the opening in a mount for a photograph. In fact, if we can afford to buy them, photograph mounts, which may be purchased at any photographic shop and at most stationery shops, would make admirable mounts for our wood.

We should see to it that, as far as possible, our specimens and their mounts are uniform in size, as they will look much neater if they are, and can be kept one above another in a box or letter-case. A flyleaf of paper should be pasted on to each mount and folded over the specimen to keep it clean and undamaged. Upon this sheet, too, should be written the name of the tree from which the wood comes, and the use to which the particular kind of wood is generally put. The more interesting and extensive the facts we can write down and keep attached to a specimen, the more valuable does it become.

IMPROVING THE COLLECTION

To the clever boy or girl many ways of improving the collection, both in appearance and in value, will occur. For instance, the mounts of the plain card or paper may be decorated in some neat way that will not distract attention from the specimen itself. Then, if we can obtain, in course of time, photographs or good printed pictures of the different trees represented in our museum of woods, the collection will be much more instructive. We can take these ourselves, or perhaps we can get them from the Government Forestry Department.

It will be very interesting, too, if we live in the country, to have a collection within a collection, by keeping together specimens of the woods of the different trees that grow in our own neighborhood. Then from time to time we can arrange our specimens round a room, and thus provide our friends with an entertaining exhibition. Trees that do not grow where we live, and whose woods we are unable to obtain locally, are often to be found in the districts where our friends live, and so by getting these friends interested in our collection we may obtain some new specimens from them. This is a specially good scheme if we have friends living abroad.

SOME WOODS TO OBTAIN

Our woods should, of course, be classified—that is, arranged in a proper order, and the proper order is according to the families of the different trees. There are the conifers, or pine family. It includes the silver fir, a white pine used for floors; the Norwegian spruce fir, the ordinary white wood of the carpenters; Carolina, or yellow pine, used for interior trim; and Norway pine, which is strong and durable. The white and red cedars, spruce, hemlock, cypress and the redwood from the giant fir trees all belong to this group.

Then there are the various kinds of leaf woods, as distinct from the woods of trees that have needle-shaped leaves, like the pines. These will be found much denser in texture than the wood of trees of the pine family.

There is the oak, the most useful of all our timber trees; the elm, a wood which is valuable on account of the fact that it will not split or warp; the ash, a tough, elastic wood, used much by carriage-builders and for oars; the wood of the various fruit-trees, such as plum, cherry and chestnut; the beech, a very hard timber; the hawthorn, a reddish white wood; the tulip tree, yellowish white in color; the box and pear, used by engravers; maple, a reddish wood; sycamore, used for machinery and in the manufacture of charcoal; alder, another wood reddish in color; walnut, willow, silver poplar, aspen, birch, elder and hazel. All these have their own peculiar colors and markings and characteristics, and are well worth obtaining and keeping carefully in our timber collection, which will soon be extensive.

TO MAKE PARCHMENT LAMP-SHADES

ARE you interested in making your own shades? Undecorated parchment shades, including candle-shades and screens, may be bought mounted on wire frames all ready for the painted design. However, these are found to be quite expensive. Why not make your parchment, paint your own design and mount the shade?

You will need the following materials: A wire frame; a large piece of brown wrapping-paper; a sheet of heavy water-color paper or cream-colored mechanical drawing-paper; linseed oil; hard and soft pencils; scissors or knife; tracing-paper; Japanese colors or water colors or dyes; braid; shellac; soft-pointed brush (suitable for painting design); flat bristle brush about 1 inch in width.

First select the wire frame for the shade or screen. This may be bought at any department store or at the ten-cent store. The frame should be strong and firm enough for the place it is to occupy. Also remember that the simpler the shape the easier it is to make. For example, a conical shape is the easiest of all to make. The curved shades of a more complicated nature are more difficult, as the reverse curve must be carefully considered.

In making the pattern of the shade a piece of brown wrapping-paper which is neither too stiff nor too heavy will prove satisfactory. The size of this paper will depend upon the required size of the shade. An easy way to make the pattern is to cut a long strip similar to a ribbon. This is to be 1 or 2 inches wider than the dimension of the shade from top to bottom. Wrap this ribbon-like paper firmly around the shade first, pasting or pinning the paper to one of the wire spokes of the frame so that it will not slip. The success of the shade depends largely upon the exactness of this pattern.

A poorly fitted shade can never be made to look beautiful. Therefore take your time in making an exact pattern. The paper for the parchment shade must be of heavy quality. A heavy water-color paper, either rough or smooth, or an inexpensive vellum or mechanical drawing-paper will be found very satisfactory. First lay the pattern on the paper selected for the shade, trace around it with a hard pencil, and then cut it out. Remember to leave at least ¼-inch margin at both top and bottom. This margin is needed to wrap around the wires or to fold back when the paper is sewed to the frame. Also leave ¼-inch or ½-inch margin at the left or right end of paper so that the shade may be pasted together.

Next sew this heavy paper onto the wire frame. Use a large needle and heavy linen thread. It is found that long stitches are better than short ones. Now begin at the middle of the lower edge of the paper and sew toward the right and then to the left edge of the paper. Be sure to avoid beginning at one end of the paper and going to the second end. Sewing from the middle to each end helps to stretch the paper evenly. The shade will then be ready for the design. It is suggested that you avoid complicated and too detailed designs, especially at the outset. It is better to select a motif in the form of a simple, well-balanced design.

The contour, or outline, of the shade will give the shape of the design. Each design is similar in shape to the side view of the shade, which will be wider at the bottom than at the top. There is one exception, however, which occurs at the right and in the back row. This design is saved by the three heavy spots, two at the base and one at the top, and also by the heavy waving line of braid extending from the top to the bottom of the shade. The design should be delicate and massed together, not having too many thin lines and motifs very far apart.

The design is now traced on both sides of the shade, both inside and outside. When tracing do not use so-called carbon-paper, as the purple line left by the paper will show through the painted design. You should make your own carbon paper by rubbing one side of tracing-paper with a very soft pencil or with soft charcoal. Next go over the design on the outside of the shade either with a thin ink-line or with heavy pencil-line.

Paint the design on the inside of the shade in strong colors. The Japanese colors may be secured in books. A small part of a leaf of the book, say the orange leaf, can be torn off and placed in a small pan of water. The water soon becomes colored and gives a liquid similar to a dye. These are brilliant and fast colors. Water colors or dye may also be used. But the important thing in this painting is always to use very brilliant colors on the inside or wrong side of the shade. Light fades out the color, and when the shade is placed over the electric or candle light, unless this fact is noted, the design oftentimes completely fades away. Do not be afraid of too strong color here. In painting the design on the outside of the shade use as delicate tones as you may desire. These delicate tones show in the daytime, and when lighted at night will be strengthened by the painting in more vivid color on the wrong side of the shade.

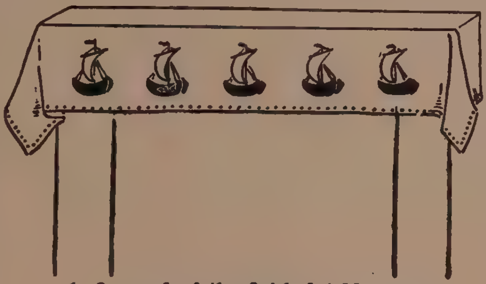
HOW THE FARMER ENLARGED THE FOLD

WE read on page 5765 of a farmer who had a fold made of 50 hurdles that would hold exactly 100 sheep. Later on, as he had a good deal of pasture land, he decided to increase the number of his animals, so he bought another 100 sheep, and this made it necessary to double the size of his fold. In order to do this he bought only 2 extra hurdles, and his companion was sure that he had made a mistake, for it seemed impossible to him that the size of a sheepfold made up of 50 hurdles could be doubled by using only 2 extra hurdles. But the farmer was quite right. In the first place, he had made his fold a long, narrow inclosure, with 24 hurdles on each side and 1 hurdle at each end. Then, to double the size of the fold he moved one side farther from the other and placed 2 hurdles at each end instead of 1, by this means exactly doubling the size of the inclosure.

A TABLE-COVER IN APPLIQUÉ WORK

APPLIQUÉ work is the application of one material to another. It is one of the many different kinds of embroidery, and is an excellent method of introducing a fine big piece of color into a pattern without all the labor that would be required if we tried to cover the same space with stitches placed very close together.

We are going to make a table-cover of linen and decorate it with appliqué in colors. First we must get 1½ yards of cream-colored linen for making the table-cover itself, ¼ yard of green material and ¼ yard of brown linen for the appliqué work. We are going to make a little border of boats with sails up all along our table-cover, as shown in picture 1, and each will have a brown sail and a green hull.



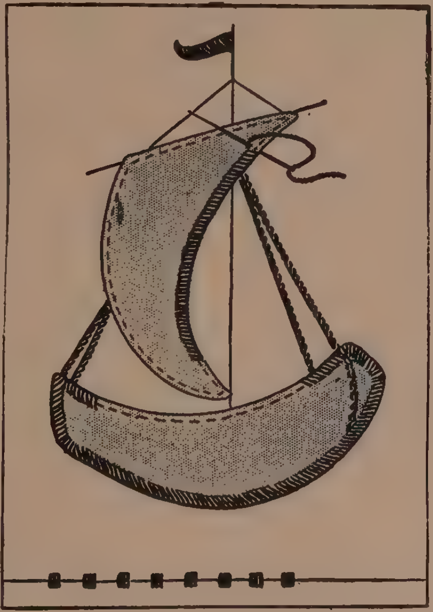
1. One end of the finished table-cover.

We must get a cinnamon-color brown, not a chocolate shade, and a pretty, soft green like a new leaf. We are going to cut out the shapes of the sails and boats from the green and brown linen, and sew them down to the cream-colored ground with brown and green embroidery silk.

The first thing to do is to cut our cream-colored linen into a piece which will fit the table or stand, leaving a piece 12 inches long to hang down around the four sides. This must be neatly hemmed to a 1-inch hem all around with a small needle and No. 60 white cotton. The hemming stitches must on no account show on the front.

It is on this part which hangs down that the embroidery is to be done. We may, if we like, carry out the idea of the appliqué design on cushions for a window-seat. We make the pillow-covers of the same material as the table-covers, and also make the window curtains to harmonize in color and pattern with the other.

The next thing we have to do is to copy on paper the sail and boat shapes twice the size of those shown in picture 2. This is to be used as a pattern for cutting out the colored linen.



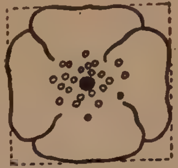
2. How the pattern is worked.

Five little ships will be enough for each side of the table-cover, one in the middle and two at equal distances each side, a few inches apart—say, 3 inches for a small border and 4 or 5 inches for a long one. They must be placed about 2 inches above the hem. First of all, iron out the brown and green linen quite flat, and cut from the pattern, very neatly, five little brown sails and five little green boats. We must use sharp scissors, and take care not to fray the edges of the linen. Placing the centre boat in position, as seen in picture 1, we pin it there and then tack it down with a needle and thread all around, a little way from the edge. We should next fix the sail in the same way, keeping it flat and avoiding puckers. Now we have one complete boat ready for working. The embroidery is done with floss silk. We should get brown and green silks to match the linen, using the brown silk to edge the green linen and the green silk to edge the brown linen.

The edging stitch is done as shown in picture 2—simply over and over, very close together so as not to show any of the edge of the appliqué. We must keep it very neat, and the same width all the way around—that is, about ⅙ inch. The appliqué must not be puckered or moved in any way; but this will not be likely to happen if we have tacked it down firmly at first. When both the sail and hull are fixed and fastened by the silk border, we can get a ruler and pencil and draw in on the cream-colored ground the mast-lines shown in picture 2; a pencil-line shows up quite sufficiently for working purposes. Then embroider over the pencil-lines in brown silk, using an ordinary crewel-stitch, worked very neatly with the stitches set quite close to one another, and taking care to put each new stitch in exactly where the last one came out. This is the whole secret of keeping a perfectly straight line when using a single stitch. Crewel-stitch is not worked along the material like hemming, but upward, as we can see in picture 4. We must knot the thread and, starting from the back of the material at the bottom of the line we are going to embroider, make a stitch ⅙ inch long by pushing the needle through from the front to the back again, bringing it up in the centre of this stitch. Then make another stitch the same length, still keeping on the pattern line, and bring the needle up again where the first stitch left off.

The flag is so simple in shape that we should have no difficulty whatever in copying it in freehand from the picture, and drawing it on the linen in pencil. It must be neatly worked in scarlet silk, and should not merely be outlined, but completely filled in.

The little line which shows the prow of the boat is quite simple to draw. We notice that it curves just a little in the middle. It is worked over exactly as the mast-lines are done. When the design is all complete we should give it a final pressing with a warm iron by laying it face downward on a piece of flannel, and pressing it well on the wrong side.



3. The poppy pattern.

4. Crewel-stitch.

Appliqué makes an excellent decoration for curtains, table-runners, and so on. For instance, a handsome pair of dark green curtains could be effectively decorated with a border of poppies, each cut out of scarlet linen, and sewed down with black wool. The centres and stamens of the flowers are also embroidered in black. Each poppy would be about 7 inches across, and the flowers should be arranged in a straight line right across the bottom of the curtain—about 20 inches from the hem would be right. Each poppy should just touch the other, and together they form a particularly pretty border. Picture 3 shows one of the poppies, in case we care to try to do a curtain or a table-cover.

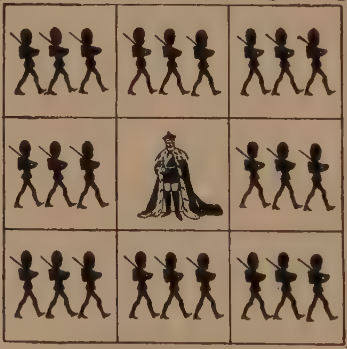
For the table-cover, which is shown in picture 1, the poppies would be used as a border all around, and in either case we must make an enlarged drawing for a pattern. Notice that the poppy itself just fits a square; this will help us to draw it easily and correctly.

As a finish to the table-cover, a line of dots, each one made of three stitches close together, should go all along the edge, as shown in picture 1. This form of decoration would also suit the table-runner. We can see how the dots are made in picture 2. The thread between the sets of dots should not be cut off, but carried on from one to the other. You may use the ship design or the poppy pattern, or if you prefer you may make up your own pattern.

Ideas for appliqué work on textiles may be borrowed from woodwork or metal-work designs. In Germany and Holland jig-saw or cutout patterns of metal, ivory or wood are applied to furniture, boxes, bookcases and other things. The patterns are riveted on.

THE PUZZLE OF THE KING'S GUARD

A CERTAIN king was staying at one of his hunting-lodges in the forest, and in this house there were nine rooms. He slept in the central room, and arranged that the twenty-four soldiers who formed his guard should be so stationed that there should be nine on each side of the lodge. They were placed as in the diagram—three in each room. The king's stay was longer than he had originally intended, and the soldiers asked if they might meet on different evenings in one another's rooms, for games and conversation. This the king agreed to, but on the condition that there should always be nine on each side of the house. Before retiring to rest on the night that this new arrangement was made, the monarch thought he would go round the lodge and count the soldiers on each side, to see that his orders were being obeyed, and to be sure that none of the soldiers had gone down to the village close by, or had allowed any strangers to visit them in the lodge. He looked carefully round and found that there were just nine on each side of the house, and so he went to rest feeling that none of his men was absent.

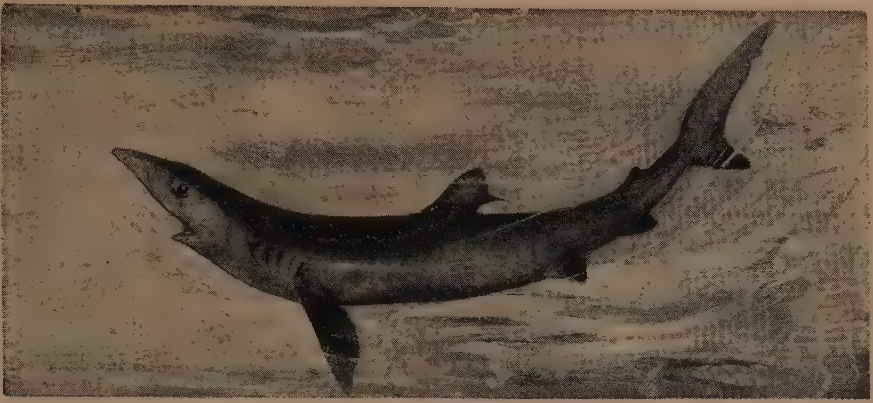


The king and his guard.

And yet, all the time, four of them had gone to the village, and were not in the house. How had the men contrived with four of their number away to maintain the full number of nine on each side of the lodge? The next night instead of any of the soldiers going to the village, four of the villagers who were friends of theirs came to the hunting-lodge, and were let in, which was against the rules. But when the king looked round, he thought all was right because there were still nine men, and nine only, on each side. How was this? On the third night, eight visitors came in, and now there were thirty-two men in the house, but as the king still found nine on each side, he did not notice the new additions. The soldiers so enjoyed the visits of their friends that on the next night they invited twelve of their friends, and now they found it difficult to know how to arrange the whole of the thirty-six individuals, so that there would be nine, and no more than nine on each side of the house. But at last they did this, and thus deceived the king. On the fifth night, instead of inviting their friends to visit the king's lodge, eighteen of the soldiers remained behind, and contrived to so arrange themselves that there should be nine men on each side of the house, while the other six soldiers went away to the village. They had a good time and returned safely.

How did the men manage to deceive the king on these five nights, and keep the same number of men on each side of the lodge, although the number of individuals in the house varied so greatly? The solution to this interesting puzzle is given on page 5979.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 5977.



The Blue Shark.

FISHES OF THE DEEP SEA

WE have tracked life all over the earth: limbed life, winged life; up the mountains, down the valleys, from tree-tops to the silent cavern and the mountain's hollow heart; and, in company with life that draws its breath in fluid form, we have floated with the current, down streams to the ocean's margin, and peeped at existence in the shallows.

And now the story must be renewed in the appalling deeps. Down in the deep sea is life abounding, strange and even loathsome, with here and there such radiant beauty as is not to be explained by human intelligence.

Only a selection of this vast sea assembly could be discussed, even if a whole volume were at our disposal. As it is, we can only look rapidly at some of the things which a nightmare alone could suggest if we did not know that they existed. First, then, the Sharks, whose near kindred, the rays, have already been mentioned.

To say that they are the tigers of the deep is not quite true. The sharks number in the family giants which, like those mammalian monsters the whales, are guiltless of offense against man unless themselves attacked by him. The Whale Shark and the Basking Shark are content with a simple, if extensive, diet of small fish, far out at sea. The Dogfish nearer home are sharks also, but they are harmless to us because they are too small to be deadly. They have been a plague to our fishermen, preying on fish wanted as human food, breaking the fishermen's lines, and cutting the nets with their sharp teeth. Because they had so unattractive a name they were not regarded as fit to eat. Under the new name of Grayfish or Rock Salmon, the dogfish come to land as fish of excellent quality for frying, and yield an oil which, as the doctors tell us, is second in value only to cod-liver oil. Then, too, their spiny skins furnish the shagreen of commerce. Cabinet-makers use it for polishing wood.

Many species of sharks are man-eaters, find them where we may. The Whale Shark of the Indian Ocean is sometimes sixty feet long and is the second largest animal in the world. We may be thankful it is a peaceful beast. But the terrible White Sharks run to as much as forty feet, with great teeth, not in one row to the jaw, as ours are, but row behind row, so that as one set wears down, the one behind moves forward, rendering the shark always fully equipped for battle.

Very ancient are the sharks. Their huge frames are mounted, not on a skeleton of bone, as is the case with most fish, but on a skeleton of exceedingly tough cartilage. When they die little but their teeth remains to attest their past. Taking teeth as a guide, it has been found by deep-sea dredging that the sharks of olden time were monsters in comparison with which present-day types are insignificant. So they, like the reptiles and the former mammals, had their giant age.

While all sharks are carnivorous, not all of them attack man. From the list of offenders we may rule out several. There is the Port Jackson Shark, common to the seas of Australia, to Japan and to California. This is an innocent one, and its teeth, arranged in series, are adapted to crushing up the shells of molluscs, and on the contents of these it feeds. The Zebra Shark of the Indian Ocean, ten or fifteen feet in length, keeps well out at sea, so has a clean sheet as far as humanity is concerned. The Fringed-gilled Shark of Japan is too small to be hurtful to us, as are the three known species of *Crossorhinus* from the same latitudes. These sharks have extraordinary leaf-like filaments about their heads. They look like a rock covered with vegetable growth, and unsuspecting fish approach them. They are harmless to man.

HOW THE THRESHER SHARK MAKES SURE OF A BIG MEAL

The Porbeagle Shark, so named from its supposed resemblance to the porpoises, is a ten-footer, a fish-eater with an appetite, but is occasionally known to assail men. The Fox Shark, or Thresher, well known in European waters, is a fisherman bold, but thanks to its small mouth it escapes condemnation. The name of thresher it derives from its habit of threshing the water when the shoal which it is pursuing tends to scatter. A thwack of the long high-lobed tail on the surface of the water and the fish scurry together —safety in numbers as the herd instinct teaches—and are then taken in mouthfuls.

We are left, then, with such demons as the white shark, the Greenland shark, the blue shark and the hammerheads, and the greatest foe of these is the first. As we all know, the mouth of most sharks is placed on the under-side of the head. It would be worth while to discuss this curious design if we knew its meaning, but we do not. It has one blessed result, that the shark must turn over to bite a big object, and to that fact many a bold human swimmer has owed his life.

Sharks do not always turn in this way to bite, because it may not be necessary to do so. The Hammerhead never does, for the reason that its mouth is placed far in advance of the ordinary shark mouth. Indeed, the structure of this creature is unique. The head is broadened out and flattened, expanding on each side into a lobe, each bearing one of the eyes. But freakish though he seems, the hammerhead is one of the fiercest of all the sharks and is the dread of every man who is compelled to enter deep water in the Indian Ocean.

BEASTS OF PREY THAT PROWL THE SEAS LIKE HYENAS IN THE JUNGLE

Still, this one is not as terrible as the great White Shark, which can bite off a man's leg or sever his body at one snap of its terrible jaws. The Greenland Shark is another ferocious foe to man, but it hunts the whale as a rule, tearing out the giant's tongue or ripping its live flesh from its body. Ordinarily alert and wary, it is so ravenous a feeder that when thus tearing the flesh from a struggling whale it may be approached quite close in a boat and harpooned as though it were drugged.

The Blue Shark is a frequent visitor to European waters, though, fortunately, it does not as a rule swim inshore. Small by comparison with the white shark, this one ranges between fifteen and twenty-five feet, and a man would be but part of a meal for it. Our blue shark is smaller.

The records of all these sharks are very horrifying. Considering the sea as a jungle, we must regard the sharks as among the beasts of prey, brutes with hyena-like instincts, cowardly, or, let us say, discreet, in that they will not always attack a man who valiantly kicks out at them in the water, but will have him with fatal sureness if he slackens.

They are scavengers. They eat the foulest organic matter cast into the sea; they have been known to swallow bags, cans, sacks of coke. Here is a shark story for you. One in pursuit of a whale's tongue made a mistake in its intended victim. The whale was one of the sperm species. It opened its mouth as wide as a shark could desire, but took the shark in bodily and swallowed it. A little later the whale was caught, and inside the whale was the shark, fifteen feet

CREATURES OF THE OCEAN DEEPS

Filefish.

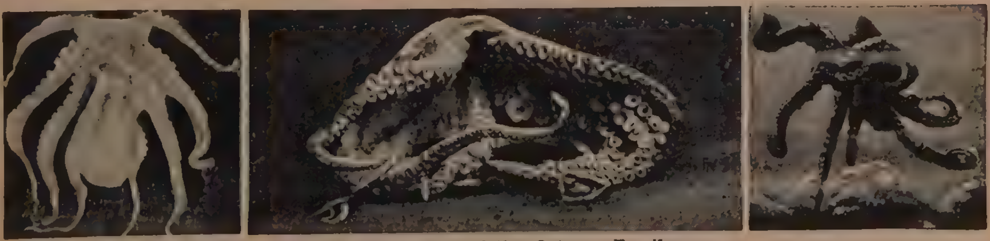
Coffer Fish.

Dogfish.

Squid.

Basking Shark.

The Cuttlefish.



Three members of the Octopus Family.

in length and as lively and vicious as when at large in the sea. There are many shark stories, and it is hard to know how much to believe.

THE TERRIBLE SAWFISH THAT CAN CUT A MAN IN HALF

After all, a shark gives a clean, terrific bite which is swift death. Next door to the sharks in relationship are the Sawfishes. Here we have huge brutes in which the upper jaw is continued in a long, flattened beak, both edges of which are set with dreadful teeth, about twenty on each edge.

This saw is used by the fish to gash open the soft under parts of a whale or a large fish, and to feed on the product of the attack; or it may kill many small fish in a school. As the giraffe delivers an amazing sidelong blow with his horns, so the sawfish with a corresponding movement of his saw can cut a man in half. We often see these implements of sawfishes in museums and antiquarian shops.

THE FIERCE GIANT WHICH DRAGGED A YACHT FROM ITS ANCHORS

In 1923 a party in Panama Bay had an adventure with sawfishes which would have sent the old-time seamen frantic with superstitious alarm. One sawfish which was taken on a baited fourteen-pound steel hook bolted with it like a harpooned whale. It dragged a fishing boat at a great pace for a quarter of a mile. In so doing it approached the steam yacht owned by one of the party. The owner cast a rope on to the vessel, where the rope was attached to a capstan to prevent the sawfish from pulling away. But the fish was by no means mastered. It hauled at the rope, dragged the yacht from its anchors, and towed it hither and thither for three hours. Eventually it was conquered, drawn inshore and landed. It proved to be twenty-nine feet long, nineteen feet round and weighed two and a quarter tons.

Later a female sawfish was caught in the same waters, thirty-one feet long, twenty-one feet round and weighing 5,700 pounds. Fish with saws six feet long and a foot broad at the base are not uncommon in the tropics. In the other amazing hauls from those same tropical waters came a shark weighing 1,760 pounds, with jaws in which two men were able to stand upright back to back, and a hammerhead weighing three-quarters of a ton.

Similarity of sound may cause confusion between the sawfish and the Swordfish, though the two genera are far apart in the scheme of classification. The swordfish is, in name at any rate, sometimes found in our nurseries: since his scientific title is one of the few beginning with *X*, he is often in the alphabet books of rhymes where *X* stands for *Xiphias*.

THE FURIOUS FISH THAT WILL TILT AT A SHIP WITH ITS SWORD

The Xiphias is most common in the warmer waters of the Atlantic and the Pacific, but comes as far north as the Grand Bank, and many are taken off the New England coast. It is common in the Mediterranean, and is occasionally seen off Ireland.

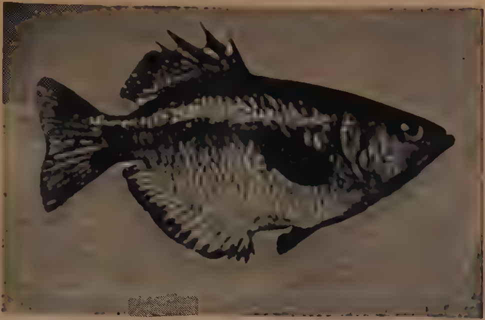
The bodily length of the adult fish may be some fifteen feet, and the sword, which is a sort of very dense bone spear, is upward of a yard long. In practice the swordfish's methods are quite unlike the stealthy approach of the sawfish. Here it is an appalling charge like a rhinoceros at a thorn bush. A tornado of furiously darting bone and muscle is behind the blow of the sword, which is driven right through an inoffensive human bather or deep into the vitals of a whale or lesser creature.

Fear is an emotion unknown to a swordfish, and he tilts at a ship with as much ferocity as at a man. Many a tough little craft in the old days of unsheathed wood came never again to port from far journeys to the tropics, and a swordfish may have known why, for these savage brutes will charge a ship, perhaps by mistake for a whale.

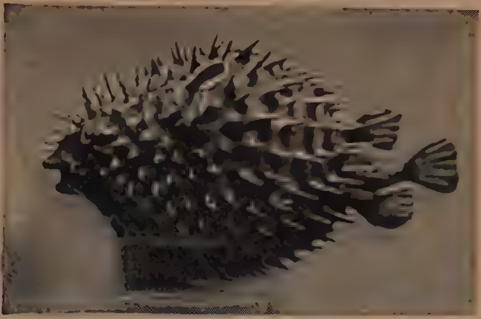
One may see in a London museum evidence of their strength. There is the broken sword of a fish which drove its implement through the hull and thirteen inches of solid timber of a ship which was sailing between Bombay and Calcutta. A second trophy is a broken sword which went through twenty-two inches of ship's timber.

These deadly living swords were five inches and more in circumference. Had they not snapped off and remained in the openings which they caused, those two ships would have been added to the long roll of tragedies unexplained at sea. Swordfish are excellent food, though they are not found in every market. They are caught by means of a harpoon, and their capture is exciting, for they struggle

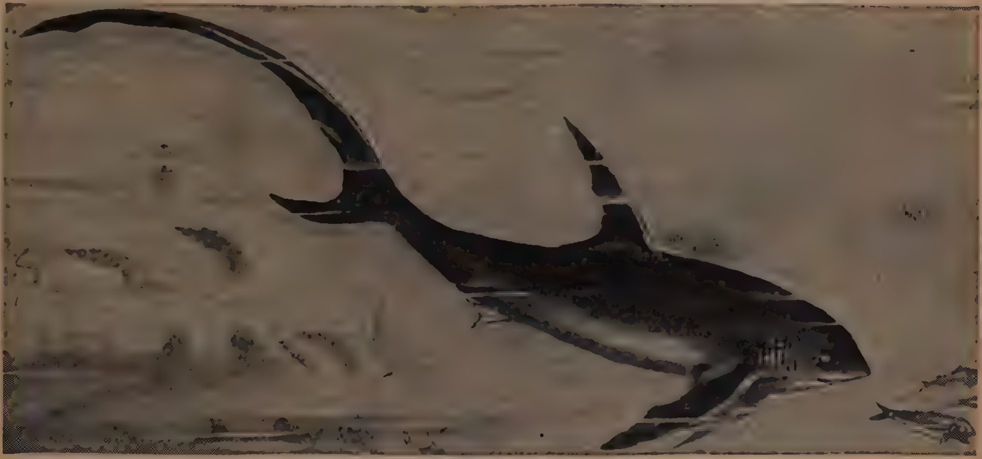
NATURE'S CHILDREN OF THE SEA



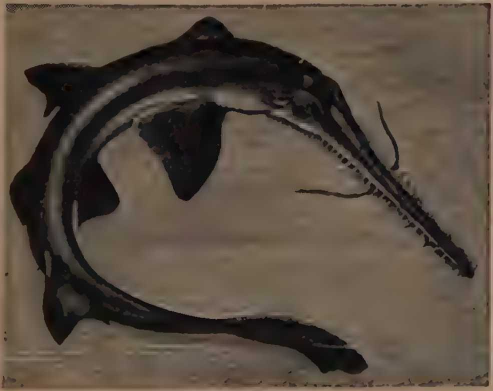
Archer Fish.



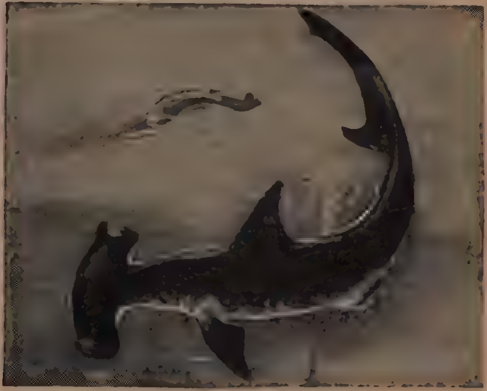
Lesser Spotted Globefish.



The Fox Shark, or Thresher.



Japanese Sawfish.



Hammer-headed Shark.

The Tope.

Porbeagle Shark.

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vigorously to free themselves. It requires a quick eye and a steady hand to strike them as they dash through the water.

CREATURES WITH MANY LIMBS AND A BEAK LIKE A PARROT'S

Next in this unpleasant gallery we must rank sea creatures which are not fishes but a lower Order, the *Cephalopods,* in which occur the octopus, cuttlefish and the squids. Carrying eight arms, every inch of them studded with sucker disks, the Octopus devotes all its ingenuity and strength to clutching a victim, man or fish, and drawing him or it with irresistible force to a cruel mouth like the horny beak of a huge parrot. The rest is a rending and ripping, piecemeal. The lesser sorts are to be found in coastal waters; but though their clinging tenacity may so seriously impede a swimmer's actions as to cause him to drown, they are not often to be feared.

In the deep sea, however, they are an abiding terror to bathers and are the creatures the diver fears most. His only chance of escape is to cut the enemy's arms away from him one by one. Often that is impossible, and it frequently happens that man and octopus are drawn together to the deck, the brute writhing and gripping till it is hacked in fragments from the terrified diver.

THE FEARFUL THING THAT HAPPENS WHEN A SQUID MEETS A WHALE

The Giant Squids are creatures of the wide ocean, and could hardly find a living in less spacious surroundings. Here are nightmares in real life, with bodies weighing perhaps half a ton. They have ten arms, two of which are longer than the others. The largest which have been found off Newfoundland weigh perhaps a thousand pounds and are forty feet or more over all. The longer arms are thirty feet or more in length and are armed with disks as big as saucers, each disk carrying a ring of horny hooks like the claws of tigers. The talons hook and hold, the disks cling by suction, and the victim is drawn irresistibly to that awful central beak.

What forms their food we do not know. When seen, they are commonly in conflict with a great sperm whale, their arms writhing like ship masts, clutching, gripping, tearing at the whale, while the whale placidly eats its living bonds.

It is from the contents of the stomachs of whales which have been caught that we obtain our knowledge of these great squids. The body of one was said to match a ship's barrel which held 350 gallons; pieces of its tentacles were found to be eight feet long and eight feet high. What a picture of immensity these figures suggest—and what a swallow for a whale!

HOW AN ENEMY FROM THE SEA FURNISHED A COLOR

All the cephalopods have the habit of swimming backward. They propel themselves by squirting water in a forward direction, so producing a rearward motion of their bodies. The retreat is aided by the discharge of a fluid which darkens the water and renders them invisible. This fluid is the sepia which was the first of pigments used by the ancients other than that obtained from vegetable substances. The chalky shell-like internal framework of the Cuttlefish is also put to good purpose. As cuttlefish bone it is often placed in bird cages. Ground fine, it is "pounce," which was used to powder the parchment on which lawyers wrote their deeds. As with the smaller species of octopus, the smaller squids are not dangerous, as they are timid and not very strong.

Having now glanced at the giants and ogres which are sometimes found on the surface, let us spend a moment in the deeps. Their range begins beyond the sunlight, which penetrates faintly in clear water to a depth of 1,200 feet. Deeper than that the fishes are what we call abyssal types. The temperature of the depths is near the freezing-point of fresh water, often below; and in any place it changes little, and there is little or no current.

It would seem that all the fish here are developments of types which swim in more ordinary conditions. They are not unique in themselves, but unique only in the life which they lead and in the manner in which their equipment and habits fit their dismal circumstances. We do not know as much about them as we desire to know, from the fact that no implement has yet been devised which can bring up great fish, which we are sure must be there, from the deeps of the sea.

Small things can be captured in ingeniously contrived trawls, but not monsters, if monsters exist. The greatest depth at which fish have been taken is just under 18,000 feet, in the western Atlantic, but there are places in the sea more than 31,000 feet deep, and probably life is there, if we could reach and capture it intact.

One difficulty in bringing such life to the surface is that fish hauled from the abysses are accustomed to sustain enormous pressure from the water overlying them. That pressure amounts to four and a half pounds to the square inch for every ten feet we descend; but, as the fish's body is charged with fluid, the pressure is from within as well as from without, rendering life possible. Remove the external pressure, however, and the effect is disastrous: the fish bursts.

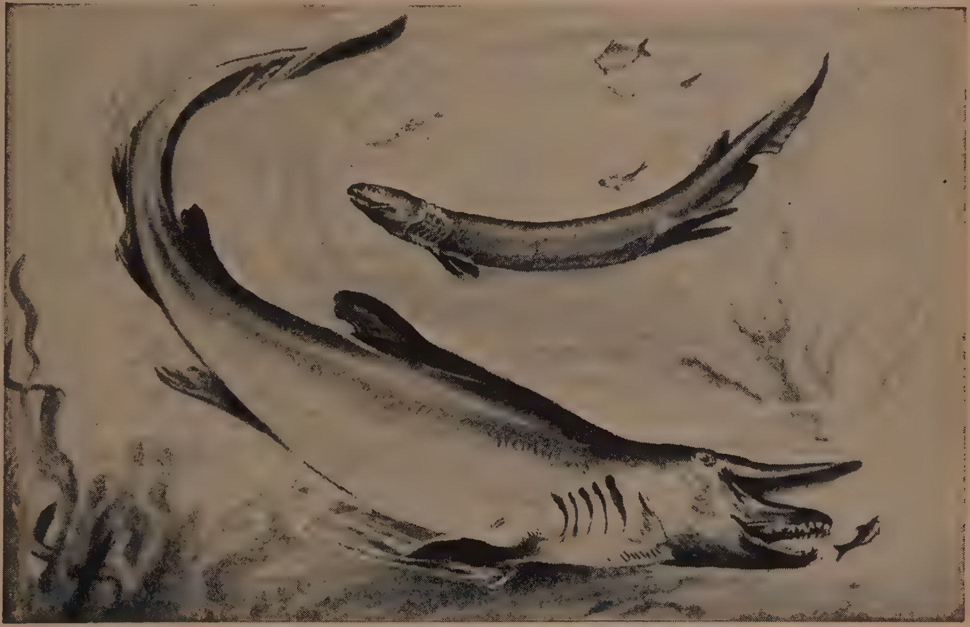
Still, venturesome students have made their hauls, and we know that the deep seas have life in its most astonishing forms. In some cases the eyes are enormously developed; in others there are no eyes at all. Some have phosphorescent lamps which they light, lamps like electric bulbs at the head, lamps like glow-worms scattered along the sides of the body.

Many have huge teeth, and some even are able to eat prey larger than themselves. Some of the eyeless fish have power to light the waters. The presumption is that the light is not for themselves but to lure other fishes, and that the lamp-bearers have a highly organized sense of smell or touch so that they are able to take advantage of the near approach of inquisitive visitors to snap them up. The species of creatures in the abysses are many in number, and some are among the most hideous and formidably armed creatures known to science.

Many of these fish are black inside and out. Others are transparent, while still others are gorgeously colored. Blues, oranges, reds, greens, violets and purples are all there, though there may be no eye to see them, and no light to see them by.

Not all of the fishes shown in the colored plates from pages 5785 to 5788 belong to the deep sea. Some are found in the shallower waters, but the ugly Black Gulper on page 5788 is a resident of the deeps. His enormous jaws are loosely held together, and he often swallows a fish larger than himself. Just above him you see the Red Frogfish with his gaping mouth opening upward and the filament moving to and fro. We must suppose that it is intended to attract the attention of other fish and bring them in reach of the open jaws. Another curious-colored member of the family is shown on page 5785.

The Oarfish may be as much as twenty feet long. The closely related Unicorn Fish is much smaller. Both are compressed, and the fin extends the whole length of the back. When found near the



THE ELFIN SHARK AND THE FRILLED SHARK

surface they are nearly always dead or dying. As mentioned above, they explode when the outside pressure is reduced as they come near the surface.

THE SCABBARD FISH WHICH COMES TO THE SHORE

The Scabbard Fish, known to Australians as the Frostfish from its extraordinary habit of wriggling to shore when frost puts a nip in the water, is really a halfway house of life between the abyss and the shallower seas. Essentially it is a deep-sea creature, but, as we see, it makes its way even to the land. It is occasionally seen in Europe as well as in Australia.

But defense and weapons of aggression are not peculiar to these fish. The Globefishes are as prickly as hedgehogs for defense; they have such formidable beaks that one has been known to eat its way out of the shark which swallowed it, and the Sac-fish branch of the family has the power to inflate a membrane covering its abdomen, turn upside down, and float with such wind or current as cares to propel it. A small and harmless specimen called by this name is sometimes seen in our waters. The *Mola*, or Sunfish, is most peculiar. It seems all head, and as it may be ten feet or more long and weigh well on toward a ton, its appearance is startling. There is a colored picture of it on page 5784.

THE HIGHLY COLORED FISH THAT HAS HORNS LIKE A COW

Nearly allied to these are the *Balistides*, a singular group, the filefish, or trigger fish, and the coffer fish. The last-named fishes are brilliantly colored, their hue being a danger signal. But there is armament of a more material nature about the Coffer Fishes, for they have bony horns which give them the name of Cowfishes.

In another way the Filefishes, often beautifully tinted, are even more interesting. In a way they resemble hyenas and the larger macaws in that they have jaws of incredible strength. They not only bite off knobs of solid coral, but they crack the great shells of the pearl oysters and devour the contents. And thereby hangs a tale of sheer wonder, but we tell it in the story of Molluscs, on page 6883. You will find pictures of many of these strange fishes in the colored section beginning on page 5781.

Having mentioned the filefish, we had better guard ourselves against the danger of confounding this with the Tilefish. This is one with a history serving to remind us that great catastrophes occur in nature as in the midst of life in civilized lands.

They were first discovered in the warm waters off the coast of Massachusetts in 1879. The master of the fishing schooner had never seen them before, nor did the scientists recognize them. They proved to be good eating, however, and there was pleasure at the discovery of a new fish of large size.

In the spring of 1882, however, there came an unwonted succession of great gales. The effect of these was as if they pushed aside the stream of warm water in which the tilefishes lived, and seas of frigid water replaced the warm. The result was amazing. The tilefish caught cold and died. One fisherman reported sailing for 150 miles through water covered with dead and dying fish. It was estimated that not less than 1,400 million tilefish were seen floating dead. There may have been many more.

HOW NATURE PROTECTS HER CHILDREN FROM CALAMITY

After the storms died down, fishermen went again to catch tilefish. Not one was found. Years elapsed without anyone's catching a tilefish, and it was feared that the species had died out. In 1892 a few were caught, tilefish returned in small numbers, multiplied, and slowly restocked the scene of that great disaster. How they returned we can only guess. Some few may have fled in fright, while there was yet time, to warmer waters out of reach of the invading currents of cold, and ancestral memory of the old hunting-grounds may eventually have brought them back. Or others, not originally of that area, may gradually have drifted in to feed in the region. Where they were before 1879, or where they went after 1882, no one knows.

But we can see, from this clean-cut example, how local species have died out in the past. It is to guard against such wholesale destruction that Nature charges her children with an energy which makes them disperse themselves as widely as possible, and so lessen the risk of total obliteration.

We leave a thousand aspects of our subject untouched. For truly the sea is inexhaustible, and so is the life within it.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 5949.

A STORY OF EARLY DAYS IN CANADA

SUSANNA MOODIE, the author of this account of pioneer days in the Canadian bush, came out from Scotland with her husband, J. W. Dunbar Moodie, in 1832. Both she and her husband were gifted writers, and her sister, Agnes Strickland, won fame as the author of the Lives of the Queens of England. Mrs. Moodie is remembered in Canada not only for her prose but also for her poetry. Her description of the sufferings and privations endured by educated people who came to settle in British North America brings realistically before us the difference that has taken place in the lot of immigrants since the early days of the nineteenth century. Traveling and communication were equally difficult, and in consequence the new-comer was doomed to loneliness and often danger. It was out of her own experience that Mrs. Moodie wrote, and the reader can feel the truth and sincerity of every word. Roughing It in the Bush is a book that never grows old with Canadians.

ROUGHING IT IN THE BUSH

IN September, 1832, when Quebec and Montreal were being ravaged by a terrible epidemic of cholera, the little brig Anne arrived in Canadian waters carrying a number of new settlers from Great Britain. J. W. Dunbar Moodie, his wife Susanna and their little daughter were cabin passengers on the small vessel. Like the steerage passengers, they were looking forward to taking up land and sharing in the boundless wealth of the new country.

Mr. Moodie had been an officer in a British regiment, had been severely wounded and had been put upon the half-pay list. To half-pay officers the Government had offered a grant of four hundred acres of land in Canada. Mr. Moodie decided he would try his fortune in the new country. An eccentric friend, Tom Wilson, had gone to Canada, and Mrs. Moodie's brother had also settled there; so the Moodies did not feel that they would be in a strange land without friends.

The two months' voyage brought them into a country in which the dreadful cholera was carrying off victims by the hundred. The steerage passengers were all disembarked at the quarantine station at Grosse Isle, just below Quebec. Mr. and Mrs. Moodie paid a visit to Grosse Isle and were astounded at the noise and turmoil among the immigrants, who sang, danced, drank and behaved worse than savages. Even the steerage passengers from the Anne, who had been quiet and orderly on board, had become as unruly as the others. Landing on the Canadian shore had changed them in their own eyes into persons of great consequence.

The sight of Quebec, however, brought tears of delight to Mrs. Moodie's eyes—"wood and rock and river" combined to make the scene her *beau idéal* of all that was beautiful in nature.

An accidental collision with a three-masted vessel provided some excitement while the Anne was anchored before the city of Quebec, but no real damage was done. The next evening the brig was towed up to Montreal by a steamer. Cholera was raging there, too, so the city was not explored.

The Moodies intended to settle in Upper Canada, so they started from Montreal the morning after landing. Their journey took them by way of Lachine, Cornwall and Prescott to Cobourg. A cold, rainy night marked their disembarkation at Cobourg to find the inn crowded. Mr. Moodie was making a desperate effort to arrange for a bed for his wife when Tom Wilson suddenly appeared and offered his room. Their old friend was thin and pale. He said he had ague. He had sold his farm and was about to return to England. His tales of life in the bush and the roguery of the people quite frightened Mrs. Moodie, who hoped that it would never be their fate to go there. When Mr. Moodie bought a farm some distance out in the country, Tom was invited to go along.

Unfortunately the ex-officer was not a man of much business ability, and he fell a prey to trickery at once. The then occupant of their newly purchased farm had promised to vacate the farmhouse at the commencement of sleighing. In the meantime the Moodies rented, without seeing it, a house to live in until that time. To their dismay, the house turned out to be a miserable hut, lacking a door and inhabited by some cattle! They arrived at this dreary tumble-down shed on a day of driving rain and were almost disheartened at the discomfort and filth.

By the united efforts of Mr. and Mrs. Moodie, Tom Wilson, Hannah, the maid, and James, the hired man, the hut was cleaned and made fit for occupation. The ground immediately around the dwelling was half cleared, with stumps still in it, and beyond that open space was the dark forest.

It was an effort for the new settlers to accustom themselves to the wild surroundings, but that difficulty faded into nothingness compared with the effort to put up with their neighbors. These neighbors were slovenly, ignorant and unscrupulous Yankees who had noses for good land. Many of them were squatters. They were people who borrowed anything, from sugar to the only plow. The articles which they did return they had ruined, and they never by any chance repaid borrowed food. In addition, they were crude and impertinent in their speech. Mrs. Moodie was pestered almost beyond endurance by their dishonest dealings. They were such riff-raff that she feared to order them to keep away in case they should revenge themselves by damaging the property or injuring someone.

The shed which the Moodies had made into a semblance of a comfortable home was sold, and they had to move into a cottage rented from a shrewd old Yankee woman who made a hard bargain. It was this woman's son who was in possession of the house on the Moodie farm, and the old mother told them he had no intention of moving out as he had promised. Her words were too true.

At the beginning of the winter an Irish lad, John Monaghan, came to the door asking for shelter. He was barefooted and poorly clothed and said he had run away from a master who beat him. Mr. Moodie engaged him as a hired man and found him a treasure. His gratitude for a few clothes and a roof over his head was very touching.

The winter was long and cold, but it wore through to spring at last. The Yankee moved out of the farmhouse at the end of May, and the Moodies took possession. An arrangement was made to work the farm on shares with an experienced farmer, but the farmer was dishonest and cheated the owners right and left.

Eventually it was decided to sell the farm and move to the bush eleven miles from the town of Peterborough. Mr. Moodie had taken up 366 acres of timber land on the shores of Upper Katchawanook Lake and planned to clear it for a farm. A log house was erected on a slight rise above the lake but some distance away.

Here it was that the Moodies settled down to the pioneer life which was to be theirs for the next few years. There was an Indian settlement near by, and the Indians became regular visitors at the house. They were treated always with respect and kindness, and they responded by many acts of friendship to their white neighbors.

Of the dangers of life in the bush the settlers had many experiences. Here follows Mrs. Moodie's account of what was, and is, perhaps the greatest terror of the woods—that is a forest fire.

BURNING THE FALLOW

There is a hollow roaring in the air—
The hideous hissing of ten thousand flames,
That from the centre of yon sable cloud
Leap madly up like serpents in the dark,
Shaking their arrowy tongues at Nature's
heart.

It is not my intention to give a regular history of our residence in the bush, but merely to present to my readers such events as may serve to illustrate a life in the woods.

The winter and spring of 1834 had passed away. The latter was uncommonly cold and backward; so on the 14th and 15th day of May several gentlemen drove down to Cobourg in a sleigh, the snow lying upon the ground to the depth of several inches.

A late, cold spring in Canada is generally succeeded by a burning hot summer; and the summer of '34 was the hottest I ever remember. No rain fell upon the earth for many weeks, till nature drooped and withered beneath one bright blaze of sunlight; and the ague and fever in the woods, and the cholera in the large towns and cities, spread death and sickness through the country.

Moodie had made during the winter a large clearing of twenty acres around the house. The progress of the workmen had been watched by me with the keenest interest. Every tree that reached the ground opened a wider gap in the dark wood, giving us a broader ray of light and a clearer glimpse of the blue sky. But when the dark cedar swamp fronting the house fell beneath the strokes of the axe, and we got a first view of the lake, my joy was complete; a new and beautiful object was now constantly before me, which gave me the greatest pleasure. By night and day, in sunshine or in storm, water is always the most sublime feature in a landscape, and no view can be truly grand in which it is wanting. From a child, it always had the most powerful effect upon my mind, from the green ocean rolling in majesty, to the tinkling forest rill, hidden by the flowers and rushes along its banks. Half the solitude of my forest home vanished when the lake unveiled its bright face to the blue heavens, and I saw sun, and moon, and stars, and waving trees reflected there. I would sit for hours at the window as the shades of evening deepened round me, watching the massy foliage of the forests pictured in the waters till fancy transported me back to England, and the songs of birds and the lowing of cattle were sounding in my ears. It was long, very long, before I could discipline my mind to learn and practise all the menial employments which are necessary in a good settler's wife.

The total absence of trees about the doors in all new settlements had always puzzled me, in a country where the intense heat of summer seems to demand all the shade that can be procured. My husband had left several beautiful rock-elms (the most picturesque tree in the country) near our dwelling, but, alas! the first high gale prostrated all my fine trees, and left our log cottage entirely exposed to the fierce rays of the sun.

The confusion of an uncleared fallow spread around us on every side. Huge trunks of trees and piles of brush gave a littered and uncomfortable appearance to the locality, and as the weather had been very dry for weeks, I heard my husband daily talking with his choppers as to the expedience of firing the fallow. They still urged him to wait a little longer, until he could get a good breeze to carry the fire well through the brush.

Business called him suddenly to Toronto, but he left a strict charge with old Thomas and his sons, who were engaged in the job, by no means to attempt to burn it off until he returned, as he wished to be upon the premises himself, in case of any danger. He had previously burnt all the heaps immediately about the doors.

While he was absent, old Thomas and his second fell sick with the ague, and went home to their own township, leaving John, a surly, obstinate young man, in charge of the shanty where they slept and kept their tools and provisions.

Monaghan I had sent to fetch up my three cows, as the children were languishing for milk, and Mary and I remained alone in the house with the little ones.

The day was sultry, and towards noon a strong wind sprang up that roared in the pine tops like the dashing of distant billows, but without in the least degree abating the heat. The children were lying listlessly upon the floor for coolness, and the girl and I were finishing sun-bonnets when Mary suddenly exclaimed, "Blees us, mistress, what a smoke!" I ran immediately to the door, but was not able to distinguish ten yards before me. The swamp immediately below us was on fire and the heavy wind was driving a dense black cloud of smoke directly towards us.

"What can this mean?" I cried. "Who can have set fire to the fallow?"

As I ceased speaking, John Thomas stood pale and trembling before me. "John, what is the meaning of this fire?"

"Oh, ma'am, I hope you will forgive

me; it is I set fire to it and I would give all I have in the world if I had not done it."

"What is the danger?"

"Oh, I'm terrible afear'd that we shall all be burned up," said the fellow, beginning to whimper.

"Why did you run such a risk, and your master from home, and no one on the place to render the least assistance?"

"I did it for the best," blubbered the lad. "What shall we do?"

"Why, we must get out of it as fast as we can, and leave the house to its fate."

"We can't get out," said the man, in a low, hollow tone, which seemed the concentration of fear; "I would have got out of it if I could; but just step to the back door, ma'am, and see."

I had not felt the least alarm up to this minute; I had never seen a fallow burnt, but I had heard of it as a thing of such common occurrence that I had never connected with it any idea of danger. Judge, then, my surprise, my horror, when, on going to the back door, I saw that the fellow, to make sure of his work, had fired the field in fifty different places. Behind, before, on every side, we were surrounded by a wall of fire, burning furiously within a hundred yards of us, and cutting off all possibility of retreat, for could we have found an opening through the burning heaps, we could not have seen our way through the dense canopy of smoke; and, buried as we were in the heart of the forest, no one could discover our situation till we were beyond the reach of help.

I closed the door, and went back to the parlour. Fear was knocking loudly at my heart, for our utter helplessness annihilated all hope of being able to effect our escape—I felt stupefied. The girl sat upon the floor by the children, who, unconscious of the peril that hung over them, had both fallen asleep. She was silently weeping; while the fool who had caused the mischief was crying aloud.

A strange calm succeeded my first alarm; tears and lamentations were useless; a horrible death was impending over us, and yet I could not believe we were to die. I sat down upon the step of the door, and watched the awful scene in silence. The fire was raging in the cedar swamp immediately below the ridge on which the house stood, and it presented a spectacle truly appalling. From out the dense folds of a canopy of black smoke, the blackest I ever saw, leaped up continually red forks of lurid flame as high as the tree tops, igniting the branches of a group of tall pines that had been left standing for saw-logs.

A deep gloom blotted out the heavens from our sight. The air was filled with fiery particles which floated even to the door-step—while the crackling and roaring of the flames might have been heard at a great distance. Could we have reached the lake shore, where several canoes were moored at the landing, by launching out into the water we should have been in perfect safety; but, to attain this object, it was necessary to pass through this mimic hell; and not a bird could have flown over it with unscorched wings. There was no hope in that quarter, for, could we have escaped the flames, we should have been blinded and choked by the thick, black, resinous smoke.

The fierce wind drove the flames at the sides and back of the house up the clearing; and our passage to the road or to the forest, on the right and left, was entirely obstructed by a sea of flames. Our only ark of safety was the house, so long as it remained untouched by the consuming element. I turned to young Thomas and asked him how long he thought that would be.

"When the fire clears this little ridge in front, ma'am. The Lord have mercy upon us, then, or we must all go!"

"Cannot you, John, try and make your escape, and see what can be done for us and the poor children?"

My eye fell on the sleeping angels, locked peacefully in each other's arms, and my tears flowed for the first time.

Mary, the servant-girl, looked piteously up in my face. The good, faithful creature had not uttered one word of complaint, but now she faltered forth—

"The dear, precious lambs!—Oh! such a death!"

I threw myself down upon the floor beside them, and pressed them alternately to my heart, while inwardly I thanked God that they were asleep, unconscious of danger, and unable by their childish cries to distract our attention from adopting any plan which might offer to effect their escape.

The heat soon became suffocating. We were parched with thirst, and there was not a drop of water in the house, and none to be procured nearer than the lake. I turned once more to the door, hoping that a passage might have been burnt through to the water. I saw nothing but a dense cloud of fire and smoke—could hear nothing but the crackling and roaring of the flames which were gaining so fast upon us that I felt their scorching breath in my face.

"Ah," thought I—and it was a most bitter thought—"what will my beloved husband say when he returns and finds that his poor Susy and his dear girls have perished in this miserable manner? But God can save us yet."

The thought had scarcely found a voice in my heart before the wind rose to a hurricane, scattering the flames on all sides into a tempest of burning billows. I buried my head in my apron, for I thought that our time was come, and that all was lost, when a most terrific crash of thunder burst over our heads, and, like the breaking of a water-spout, down came the rushing torrent of rain which had been pent up for so many weeks.

In a few minutes the chip-yard was all afloat, and the fire effectually checked. The storm which, unnoticed by us, had been gathering all day, and which was the only one of any note we had that summer, continued to rage all night, and before morning had quite subdued the cruel enemy whose approach we had viewed with such dread.

The imminent danger in which we had been placed struck me more forcibly after it was past than at the time, and both the girl and myself sank upon our knees and lifted up our hearts in humble thanksgiving to the God who had saved us by an act of His providence from an awful and sudden death. When all hope from human assistance was lost, His hand was mercifully stretched forth, making His strength more perfectly manifested in our weakness:—

"He is their stay when earthly help is lost,
The light and anchor of the tempest-toss'd."

. . . .

Such is Mrs. Moodie's own description of her very terrifying experience.

A logging bee followed the burning of the fallow, and sixteen acres of land were prepared for the fall crop of wheat. Then epidemic of ague and lake fever attacked all the settlers in that region. Mr. Moodie fell a victim to it; little Addie, the second Moodie child, was seriously ill with an infant complaint; Mary, the servant, had to return to her own home; and just at that time a little son was born! Thus, Mrs. Moodie had her hands full and passed a very anxious winter.

The summer of 1835 brought some bright moments—the promise of a bountiful crop and a pleasure trip by canoe to Stony Lake. But the brightness turned to gloom when continued rain totally spoiled the crop. This left the Moodies on the verge of poverty. Tea and sugar became luxuries not to be thought of. Dandelion roots were used to make a substitute drink. Fish could be caught in the lake, fortunately. But six fat hogs were driven into the lake by a ruffianly neighbor, so game had to be depended upon for a meat supply.

A chance acquaintance of Mr. Moodie invited himself into the household and remained there for many months, grumbling at the food, yet doing little or nothing to merit the meals and shelter he received.

In February, 1837, the Moodie homestead caught on fire, and for some weeks the family were quartered on neighbors. When they returned to their own roof a lucky shot brought down a bear which helped fill the larder.

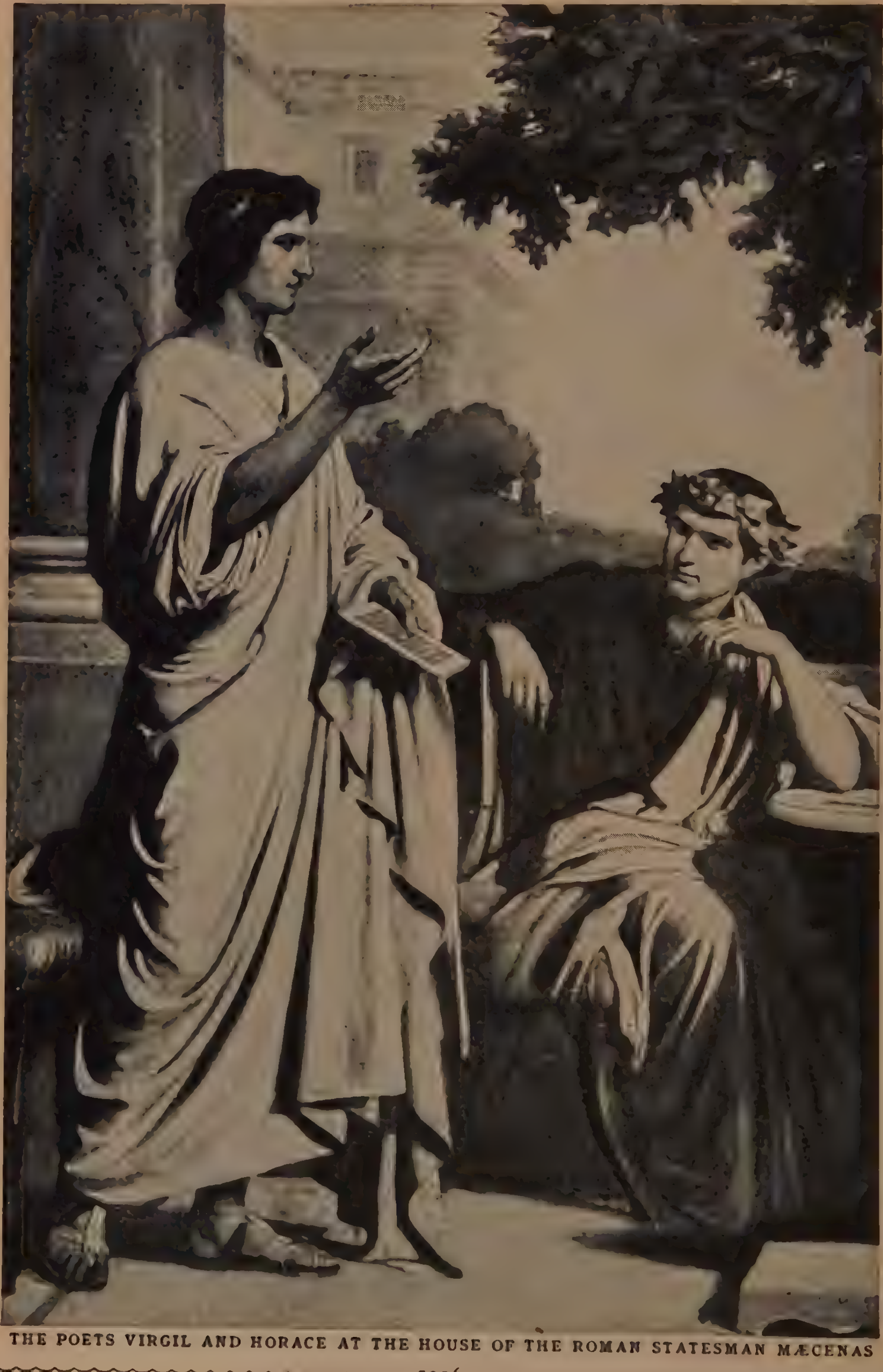
The summer and fall came and went without much that was eventful. Unfortunately in October Mr. Moodie broke a small bone in his leg.

The rebellion in upper Canada broke out on December 4, 1837, and all loyal gentlemen were called upon to join in putting it down. Mr. Moodie was given the rank of captain in one of the militia regiments organized in Toronto. The pay he received was of great assistance to Mrs. Moodie, who had been left on the farm. The rebellion was put down, but Captain Moodie retained his position for some time. Mrs. Moodie had written some articles for magazines, and again she was requested to write for a Montreal periodical. She did so, and began to earn money to help the family purse. It looked as if better days were dawning for the Moodie family.

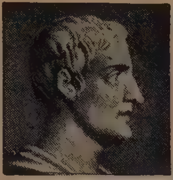
The position of sheriff in another district was offered to Captain Moodie. He accepted it and sold out his farm in the bush. The sorrows and poverty of the first years in Canada were over.

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 6115.

GREAT FIGURES IN ROMAN LITERATURE



THE POETS VIRGIL AND HORACE AT THE HOUSE OF THE ROMAN STATESMAN MÆCENAS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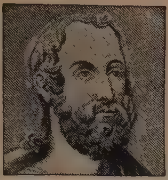
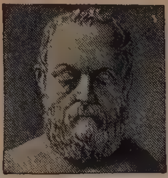

Pliny the Elder.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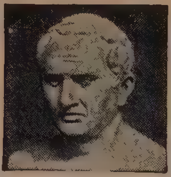
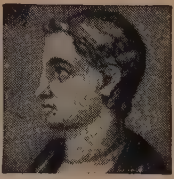
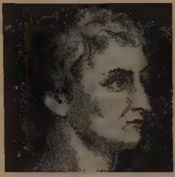
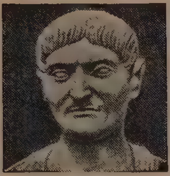
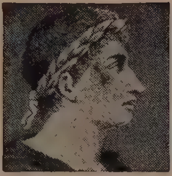
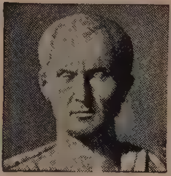

Cicero.

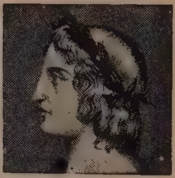

Horace.


Livy.


Sallust.


Ovid.


Cato.


Virgil.

THE LITERATURE OF ROME

THE poetry and the tales of the Roman people have a much more romantic beginning than a Latin primer would lead a boy or girl to suspect. Before there was any such bothering thing as grammar, and before there was any such wonderful invention as writing, the dark-haired and olive-skinned people of Italy worshiped their gods with songs and dance, and celebrated their festivals with literary compositions offered to the nymphs and fauns whom they believed to haunt their streams and woods.

Little is known of these primitive utterances of the Latin race. The lullabies sung by the mother to her child, the charms uttered by the wise man for the preservation of the flock, the homely maxims of the husbandman, the old proverbs handed down by the grandfather, the dirges wailed at funerals by mourning women, and the songs sung by the leaping priests of Mars as they thrashed the shields of the god—of these interesting things only a few scraps are now to be traced even by the most industrious scholars. These things are the roots of Latin literature.

We know that one of the proverbs ran, "Be first to be silent, last to speak"; that the deity was addressed in the form, "Lord of Light, when thou thunderest, all men hear and tremble because of thee"; that a Saturnian verse declared every man to be the architect of his own fortunes; and that the comedies performed with masks had always four characters—a Fool, a Braggart, a Dotard and a Rogue.

Why is the traditional literature of the Romans so scanty? The answer is that Italy lay for hundreds of years under the terrible scourge of civil war, and that when, after five centuries of struggle, the city of Rome acquired the mastery of the country, the childish utterances of the Latin soul had long since been stifled. Greek culture had its origin six hundred years before the birth of Jesus. It was not until the beginning of the third century B.C. that an almost barbarous Rome was able to give peace to an almost savage Italy.

The Greeks had long ago established colonies in the south of Italy, and they had given their alphabet to the Romans. When Pythagoras established his monastery in Italy before 500 B.C., the city of his choice, Crotona, "far surpassed any city in the mother country in literature, opulence and refinement." We may easily imagine, then, how the shabby, little, barbarous Rome of those days would be conscious of shortcomings directly she came into full contact with the literature of Greece—the poems of Homer, the philosophy of Plato and Aristotle, the history of Thucydides, and the tragedies of Æschylus.

So we find that the historical beginnings of Roman literature are Greek, and nothing but Greek. At the capture of Tarentum, in 272 B.C., a Greek named Andronicus was captured and brought to Rome, where he was sold as a slave to a nobleman named Livius. In the household of this powerful Roman, Latin literature had its true beginning.

Andronicus acted as a tutor to the children of Livius. He needed a textbook for his lessons, and so translated a part of Homer's Odyssey into Latin. On gaining his freedom he called himself Livius Andronicus, and became first a schoolmaster, and then an actor, a stage manager and a playwright. His plays were rough translations of Greek tragedies and comedies.

THE TROUBLED LIFE OF THE FIRST TRUE LATIN AUTHOR

The first of true Latin authors was a Roman citizen who had fought in the wars against Carthage. His name was Nævius. His tragedies and comedies were translations from the Greek. They were better than the work of Andronicus, and were chiefly comedies. But the life of Nævius, like that of most pioneers, was one of trouble and even of tragedy. By one of his gibes he aroused the wrath of a powerful family in Rome and was flung into prison; and for indulging too freely in satire on his release he was sent into exile. He deserved a statue in every Roman city, for he turned for inspiration from Greek literature to the deeds of his own countrymen, and gave to the Romans their first epic poem, *Bellum Punicum* (The Punic War). His subject was the great war with Carthage, and in this epic he goes back to the traditional origin of Rome. His picture of Æneas inspired Virgil to write the greatest work in the Latin tongue.

After Nævius came Ennius, who said he had three hearts, because he could speak Greek, Oscan and Latin. He, too, was a soldier, and fought in the Second Punic War. In 204 B.C. Cato found him soldiering in Sardinia and persuaded him to come to Rome, where he set up as a schoolmaster and playwright. From this time till his death, in 169 B.C., Ennius was one of the most industrious of writers. He said: "I never write poetry unless I have got the gout"; yet he wrote a great deal of verse, as well as translations, epigrams, satires and Roman historic dramas. The greatest of all his works is his Annals, an epic on the history of Rome from the fabulous days of Æneas down to his own times.

THE WRITER WHO WAS EVER AT THE SERVICE OF THE MANLY VIRTUES

Something of the Roman spirit may be seen in his words:

Broad-based upon her ancient ways and men
Standeth the Roman State.

The reference to "men" in these lines is characteristic of Ennius, who dearly loved a hero and ever held his three hearts at the service of manly virtues. He described Curius as one "whom none with steel might overcome, nor gold"; and of Fabius, the crafty general whose wise tactics made him hateful to nervous and impatient politicians, he says:

One man for us by waiting saved the State.
Nought for men's talk he cared, for safety
much.

Alive at the same time as Ennius, Plautus (254-184 B.C.) was no less industrious as a writer, but as a writer of comedy. The Cambridge scholar, Mr. Dimsdale, thus summarizes his life:

> Born about 254 B.C. at Sarsina, in Umbria, he came to Rome, where he occupied himself as an actor or a stage-carpenter. With the savings thus acquired he engaged in foreign trade, lost them again, and returned to Rome in poverty.
>
> To such straits was he reduced that he was obliged to take service with a baker and work in a flour-mill. While in this position he began to write plays, encouraged, perhaps, thereto by his former connection with the stage.
>
> By these means he seems to have recovered his position, and continued to write till his death in 184 B.C.

A ROMAN WITH A GENIUS LIKE THAT OF CHARLES DICKENS

Such was the life of the great comic writer whose book lay under the pillow of St. Jerome and was often in the hands of Martin Luther. He wrote in the Greek spirit, he cheerfully speaks of his countrymen as barbarians, and the scene is almost always in the Athens of long ago. But not for these things is Plautus famous. His charm lies in a genial attitude toward the stupidities of mankind, a keen eye for its absurdities, and a mind which has something of Charles Dickens' genius for sketching a character in a few strokes.

He was the first Roman to produce a compact comedy with an exciting plot, and although Horace afterward said of him that he hurried across the stage in slippers down at the heel, scholars generally agree that Plautus is one of the greatest creators of Latin literature.

Next to Plautus comes Terence (195–159 B.C.), one of Julius Cæsar's favorite authors. Some of his phrases have passed into the language of every nation. *Homo sum: humani nihil a me alienum puto,* is a philanthropic ejaculation often to be found even in the modern newspaper. It means: "I am a man, and nothing human is beneath my notice." We often see the words *Quot homines, tot sententiæ,* meaning, "So many men, so many opinions." They occur in a play of Terence. One of the characters asks for advice. "Advance," says one; "Retire," says another; "Deliberate," says a third; and, *"Quot homines, tot sententiæ!"* exclaims the baffled inquirer.

THE AFRICAN SLAVE WHO WAS RECEIVED INTO THE BEST ROMAN SOCIETY

Terence was not a Roman. He hailed from Africa as a slave, and became the property of a Roman senator who gave him a good education and introduced him into the best Roman society. He was handsome, scholarly, charming. He felt that Plautus was a little vulgar, and disdained to write, as Plautus did, in the language of the street. He dealt with the same rather coarse themes as Plautus, but his manner was altogether different—less boisterous, less rollicking, less slipshod. It was his boast that his plays were "pure discourse." He complains that the Romans preferred a tight-rope acrobat or a gladiator to fine literature; and he often produced plays which were a failure. On one occasion a play of his had scarcely begun when nearly the whole audience rose and made vigorously for the exits; a rumor had spread that there was a boxing-match, or something of the kind, across the way.

Such an artist was Terence that success never satisfied him, and in 160 B.C. he went to Athens to study the Greeks in their own land. But for him the end was at hand. In 159 he died, either by shipwreck on his way home or of disease in a Greek city—nobody knows which.

From the Romans comes to us the pantomime, with columbine, harlequin and pantaloon. The Romans called it the *mime.* Laberius is one of its chief authors. He was a knight, and scorned acting, but Julius Cæsar in a vulgar mood once forced the old warrior to act with Syrus, a Syrian slave, in one of his own mimes. The proud Laberius came on the stage and in a pathetic prologue explained his humiliating position:

> I, who for years past count have kept my name
> Unblemished, left my house a Roman knight,
> And shall return a mime! I' faith, to-day
> I've lived a day more than I should have lived.

He hit back at Cæsar more than once, and in one famous line prophesied the end of that incomparable Roman: "He whom the world fears needs must fear the world."

Mr. Dinsdale, in his History of Latin Literature, gives some examples of the wit of the mime, as learned by schoolboys in the days of St. Jerome; some of them being attributed to Seneca:

> Fortune's like glass, most brittle when most bright.
> A remedy for all your wrongs: forget them.
> I tumbled into love like a cockchafer into a basin.

LUCILIUS AND HIS GOOD-HUMORED ANSWER TO HIS FOES

Something new in Roman literature came to birth with the appearance of Lucilius in 180 B.C. A cavalry soldier under his friend Scipio Africanus the Younger, Lucilius returned to Rome at a time of political intrigue, saw everything with a cool brain and a mind rooted in the ancient virtues, and proceeded to satirize the evils of his days. It was said of him that he "lashed the city"; but also that he

> Assailed the lords and those of humbler birth,
> Kind to worth only, and the friends of worth.

He was a bachelor, a lover of horses, and on the best of terms with his slaves. When attacked, he replied that he didn't in the least mind being soundly drubbed, tossed in a blanket, plucked and singed, or even laughed at; "loss of temper," he explained, "is a crime." Later, in greater hands, satire was to be a distinguished achievement of Roman civilization.

CATO SHOWED HIS CONTEMPT FOR THE ARROGANT ARISTOCRATS

But a nobler thing than satire was the aristocratic mark of the Roman on the world's literature. History had been always deemed by them a matter to which gentlemen might fitly turn their hands. To write for the mob in a theatre was unworthy of a Roman, and to write poetry was beneath the dignity of a soldier. But history would be read only by the educated, and therefore a cultured Roman citizen might venture to compose historical works.

Thus we find the splendid old Cato (234–149 B.C.) taking up his pen as a part of his patriotism. He loved the old Roman virtues, and hated with all his stubborn soul the slippery character of the average Greek. Therefore he set himself the task of keeping Greek influences at bay. "Whenever that nation gives us its literature," he said to his son, "the Roman State will be ruined."

Before he turned to history—and he is the father of Roman history—Cato had written on farming, health and politics for the benefit of his son. Something of his mind and character may be seen in such utterances as these:

> Buy not what you want, but what you must have: what you don't want is dear at a penny.
>
> It is better to wear out than to rust out.
>
> If nothing is being done, expenditure is going on all the same.
>
> An orator is a good man speaking.
>
> Stick to the matter and the words will come.

But the finest of his strokes was the omission of all the names of the generals from his account of the Punic Wars, a stroke marked with a sly hit at the self-glorifying Roman families by his particular mention of the name and doings of the bravest elephant on the Carthaginian side. If the old man hated the Greeks, he hated the vanity and swashbuckling arrogance of the Roman aristocracy. He loved nature, he loved the land, he loved Roman virtue. To prove his contempt for the Greeks he wrote his history in Latin, and from his day onward Roman history was composed in the language of the Romans.

An influence was now at work on Roman character more powerful than that of Greek poetry. It was the influence of Greek philosophy. All the rough eloquence of old Cato could not check the flooding-in of Plato's thoughts, Aristotle's investigations and the semi-scientific philosophy of Epicurus. Greek speculation became the rage in fashionable circles, and once more the Greek schoolmaster was abroad.

Lucretius, the great Roman poet-philosopher, was born about 98 B.C. Professor Mackail is right in saying, in his volume of Latin Literature, that Lucretius was drunk only with the majesty and glory of nature. That was his single crime, and scholars have long since forgiven him for it.

His passion for science enabled him to compose a work which is one of the most beautiful monuments of poetic genius. Some of his phrases, such as "the serene strongholds of the wise," have comforted lonely thinkers in all ages since his day; while such lines as "the flaming ramparts of the world," and "the solemn fires of night," will never die.

THE CHANGE THAT CAME OVER THE POETRY OF ROME

But the Roman mind was beginning to tire of noble and serious poetry. "A great book," said a writer of the time, "is a great bore." The change is marked by Catullus, who was born in 84 B.C. and began by writing love lyrics. He turned away from the great religious problems of man's soul to pour out his heart in love for a Roman lady. At the end of his romance he exclaims: "Women's promises are writ in water," and speaks of his love as a disease; and when the lady, repenting of her falseness, sues for his favor, he replies:

Let her not look for love of mine hereafter.
Love that once was is perished—hers the doing—
Drooping like hedgerow blossom by the plowshare touched in its passing.

He turned to politics, and the same "passionate simplicity" which marked his love poems marks his satires. He was one of the greatest masters of style and managers of metre that have ever lived, and Swinburne says truly that when an English poet attempts to follow him in these fields, Catullus "makes mouths at our speech." To him it was all so easy, to others an agony of effort.

ONE OF THE GREATEST MASTERS OF STYLE THAT EVER LIVED

We now come to the man who "created a language which remained for sixteen centuries that of the civilized world, and used that language to create a style which nineteen centuries have not replaced, and in some respects have scarcely altered."

Cicero, who lived from 106 to 43 B.C., strikes us in many ways as a disagreeable person. He loved power and would sacrifice his principles to attain it. His brain was at the disposal now of Pompey, now of Cæsar. He could thunder, but he could cringe. In some respects he was a coward, and we might almost say of him that he was a man "whom treachery could not trust." Yet he took the simple Latin prose of his day, which was merely one of the ancient dialects, as Professor Mackail truly says, and made it the universal language of mankind.

THE NEW WEAPON OF THE ROMANS FOR THE CONQUEST OF THE WORLD

He thrust the Greek language out of his path as a superstition and a barbarism. So majestic was the sweep of his prose, so ordered and rounded its sonorous periods, that it filled the heavens with a new music, and gave the Romans a newer and greater weapon for their conquest of the world. His favorite quotation was the Greek line, "Knowledge of all that is, is the supreme delight," and his restless soul ranged over the whole field of human inquiry, adding little or nothing to the knowledge of mankind, but giving to all knowledge a prouder expression.

Mommsen could say of him: "Only an advocate, and not a good one"; and Landor that he "sometimes wore at the bottom of his rhetorician's robe a flounce too many"; but no such sneers can do away with Cicero's prodigious triumph as the creator of Latin prose.

Cæsar and Sallust are interesting writers, particularly Sallust, but they contributed little new to literature and need not detain us in this brief summary. We must hasten to speak of Virgil, who was living in Rome at the time of the Crucifixion and was a friend of Augustus Cæsar. Latin literature was in his time at its highest glory, and in the midst of that glory he shone out as its brightest sun.

THE SHY PEASANT BOY WHO BECAME A GREAT ROMAN POET

Virgil was born near Mantua. His father, a peasant, had married his employer's daughter, and with her money Virgil was given a good education. The boy went to Verona, Milan and Rome. He was shy and delicate, and spoke with a curious slowness. Public life did not attract him. He shrank from noise, crowds and ambition. With gratitude he returned to the country and wrote poetry about peasants and sweet fields. He conceived the idea that something in nature resists man, and that the chief glory of human life lies in opposing the soul to nature. God Himself had decided that man must rouse the slumbering globe to greater life, thereby "whetting the minds of men with care on care, suffering no realm of His in drowsy sloth to stagnate." Lucretius was a fatalist, Virgil was an evolutionist. Lucretius taught that man was helpless in the hands of nature; Virgil that man is nature's master. With pride he hails Italy as "the mighty motherland of harvests and of men." Man made the harvests, and the harvests made man.

When he came to write his immortal epic, the Æneid, Virgil made his hero Æneas no superman, no godlike hero of a saga, but the instrument of God's Will. Rome's place in the world is a part of the Divine plan. Æneas is not merely the father of a nation, but the servant of a Destiny which regards all peoples as materials for the Divine plan. And with these high things goes the most exquisite passion for simple human pity.

Something I know of trouble, and therefrom
Learn how to help the suffering.

HOW VIRGIL RAISED ROMAN POETRY TO THE LEVEL OF THE GREEK

He elevated poetry and he elevated mankind. In the most beautiful language, and with a strange power of making his words convey the very sounds of that which he is describing—for instance, the galloping of a horse—this shy and solitary man raised Roman poetry to the level of the Greek, and endeared himself to all the generations of mankind.

Of a wholly different temperament was his contemporary Horace, who was born in 65 B.C. and died in 8 A.D. Son of an auctioneer's clerk, who every day in childhood took him to school, he became a man of the world, the friend of the great, and one of the most popular figures in the Roman world. He was an altogether delightful man. He faithfully and gratefully loved the rich patron Mæcenas, who gave him a farm and enabled him to live as a poet. He described Virgil, who had introduced him to Mæcenas, as "half of my soul." He said of travelers overseas that they change their skies but not their minds; and reminded cranks that "Dame Nature, pitchforked out, will e'er return."

In one respect this easy-going, tolerant, pleasure-loving and witty Roman was a great man. He saw, as Goethe saw long after, and Carlyle after Goethe, that self-culture is the romance of human existence, that the mind is its own heaven or hell, and that the heaven of every man is not across the water, but *here* and *now*.

> 'Tis here that what you want you'll find,
> Here at Ulubræ, *given an even mind.*

Unlike Cicero and Virgil, Horace deliberately chose the simplest of words, the forms of the commonest speech, and addressed himself modestly and genially to the average human intelligence. Thus he could say of himself that he had "reared a monument more enduring than brass." Simple, true-hearted and kindly people will always love him.

In this same Augustan Age lived Ovid, from 43 B.C. to 17 A.D. An aristocratic and witty observer of the human comedy, he offended Augustus and died in exile. Some of his verse was considered to have an immoral tendency, and his banishment is said to have been due to this fact. But much of his work was of solid value, and he had a serious turn, and could say with truth:

> A god within our bosom dwells,
> And when he stirs we burn.

THE FAMOUS POEM OF OVID THAT INSPIRED WILLIAM SHAKESPEARE

But his chief interest for us is his influence on art. Everybody read and loved his fabulous tales of ancient days. "The gods whose figures sprawl across the ceilings of Italian palaces, or whose merry adventures have been stitched into the tapestries of Gobelins and Arras, are Ovid's gods," says Mr. Dimsdale, and in saying it he reminds us that Ovid's famous mythological poem Metamorphoses inspired Boccaccio and Ariosto, Chaucer and Gower, and the great Shakespeare himself, with many ideas. "The sweet, witty soul of Ovid," says Francis Meres, "lives in mellifluous and honey-tongued Shakespeare."

Of Livy, who flourished between 59 B.C. and 17 A.D., we may say, with Dr. Arnold, that "the use of him is almost that of the drunken helot; it shows what history should not be." He wrote history with a moral purpose, took what suited that purpose, made no researches, and sought to be eloquent. Nevertheless, so great is his subject, and so keen his instinct for picturesque or dramatic situations, that many will read him in all ages.

But the man himself is profoundly interesting. He wrote history, he said, to escape the sights of evil and folly which everywhere confronted him. To him the Roman commonwealth was the greatest thing in the world, and he wrote of its order, its discipline, its strength, its simple piety and its quiet fortitude with the passion of a poet. This history was published in parts, and had something of the success which attended Macaulay's History of England. A Spaniard traveled all the way from Cadiz merely to look on Livy, and returned without bestowing a glance on the palaces and temples of Rome. Marvelous popularity never turned his head. He believed Rome was dying, and his heart was sad.

THE WISE SAYINGS OF SENECA AND HIS REMARKABLE RISE TO POWER

In turning from Livy to Seneca we turn from the high noon of the glory of Rome to the falling twilight. Seneca was born at Cordova, but he was taken to Rome as an infant. He lived from 3 to 65 A.D., and was always a strange character. At one time a vegetarian, slovenly in dress, and an ascetic, he rose to great power, amassed great wealth, became Nero's tutor, crawled before emperors, and was sentenced to death for conspiracy. Some of his sayings are admirable:

> He most of all possesses riches who least needs them.
>
> Contemplation is a kind of action.
>
> We ought to choose some good man, and always fix him before our gaze, and live as if he were always beholding us.
>
> I am wont to pass into the camps of other folk, not as a deserter, but as an explorer.

HOW PLINY THE ELDER WENT OUT IN A BOAT TO HIS DOOM

The Elder Pliny, who was one of the victims of the destruction of Pompeii, was a historian and a voluminous writer on natural history. His early writings on the wars between the Romans and the Germans were used by Tacitus, whose works, more trenchant in style, superseded those of Pliny. Pliny's thirty-seven books on natural history were a survey of both nature and art as they appealed to the Romans.

The Younger Pliny was with the historian when the eruption occurred, and both were in safety; but the historian's intense curiosity led him to cross in a boat to the neighborhood of Castellamare to study the eruption from a nearer point of view, and he was overwhelmed in the rain of débris from the crater. The nephew stayed behind, making extracts from a book of Livy. These details are given as part of a letter to the historian Tacitus, describing the eruption.

THE BOOKS OF PLINY THE YOUNGER THAT TELL US OF OLD ROME

The Younger Pliny is now known to us through his nine books of charming Letters, describing in detail the life of a cultured Roman gentleman, and by his Correspondence with Trajan, in which he discusses the persecution of the early Christians. Pliny the Younger served in public offices under Domitian, Nerva and Trajan, and toward the close of his life was the governor of Bithynia. After his death a marble tablet was placed in the public baths of his birthplace, Como. Afterward it was broken into six square pieces, and four of them were built into a tomb in Milan. Only one of these fragments still exists, but the full inscription is known through ancient transcripts. The Younger Pliny's Letters are among the most readable of the books that have come to us from the eighty years that followed the rise of Christianity.

At Martial we can only glance by quoting one or two of his sayings:

There is only one way to replenish my coffers.
I must e'en sell the presents you gave me.
    What offers?
Your honor, Vacerra, the ancients alone,
And never praise poets unless dead and gone;
Your pardon, if unceremonious I seem,
But it is not worth dying to gain your esteem.
With all thy heart embrace thy lot,
Wish not for death, and fear it not.

Most beautiful of all his utterances is the epitaph on a child who died at six years old:

Rest on her lightly, O Earth;
Lightly she rested on thee.

FAMILIAR PHRASES THAT HAVE COME DOWN TO US FROM TACITUS

Tacitus, born in 55 or 56 A.D., is one of the great historians. He cared little for form. With him thought was always the first and overwhelming consideration. He sought brevity only that the thought might strike more quickly home. "Wrong a man and you will hate him" is a typical specimen of his thought and his style. Our paradoxical phrase "conspicuous by his absence" may be traced to Tacitus, who also gave us another familiar phrase in "the sinews of war."

This summary must end with Juvenal. It is a suitable end, for Rome is now visibly perishing. Wealth and ostentation, gluttony and drunkenness, superstition and depravity were preying on the Roman body, which was now almost a corpse, and would not be recognized by Cato any longer as Roman. It was a terrible Rome, in which the poisoning of husbands by their wives was a matter of everyday occurrence. All the old aristocratic notions of duty and simplicity were dead. All the principles of manful self-reliance in the people were trodden down.

Juvenal was no saint, and no great patriot. He was a middle-class man with strong feelings and a contempt for weakness as well as for vice. But he saw that the change which had come over the people of Rome was perilous and contemptible. He raised no finger to alter this state of things, but wrote fierce and acrid satires to relieve his feelings and amuse his hours. "True are the tears for loss of money shed" is an example of his cynical wit. "No man ever became a villain suddenly" is an example of his clear-sighted moral power.

Most people know of his phrase *Mens sana in corpore sano*—"a sound mind in a sound body." He was not a great man, but he used his skill with terrific energy "to lash the city" and to make wealth look as ridiculous as poverty always makes the poor man look to the rich.

When Vespasian died he uttered a jest. "Alack!" he exclaimed, "I fancy I am turning into a god." The truth is, perhaps, that old Cato was right, and that Greek culture was too fine and exquisite a thing to find a resting-place in the tough and rather coarse Roman body. The last days of Rome witnessed cruelties and horrors which might have shocked even savages, and to be witty was the chief end of those whose duty it was to guard the soul of civilization.

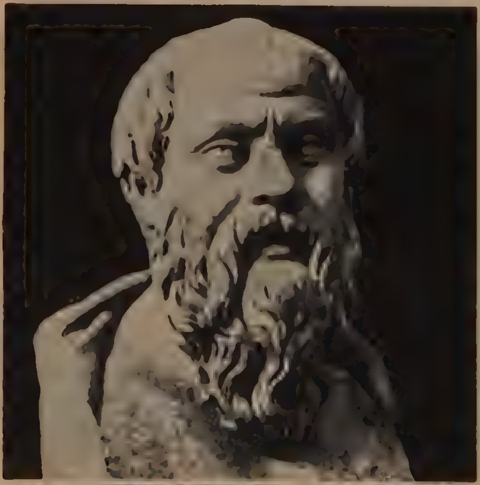
THE ROMAN SPIRIT AS A BRIDGE FOR THE GREAT SOUL OF PLATO

Striking is it for us to reflect on the fact that Marcus Aurelius wrote his pretty thoughts and his engaging moralizings, not in the manful Latin language of Cato and Tacitus, but in Greek. The Roman spirit was dead.

THE NEXT STORY OF LITERATURE IS ON PAGE 6149.

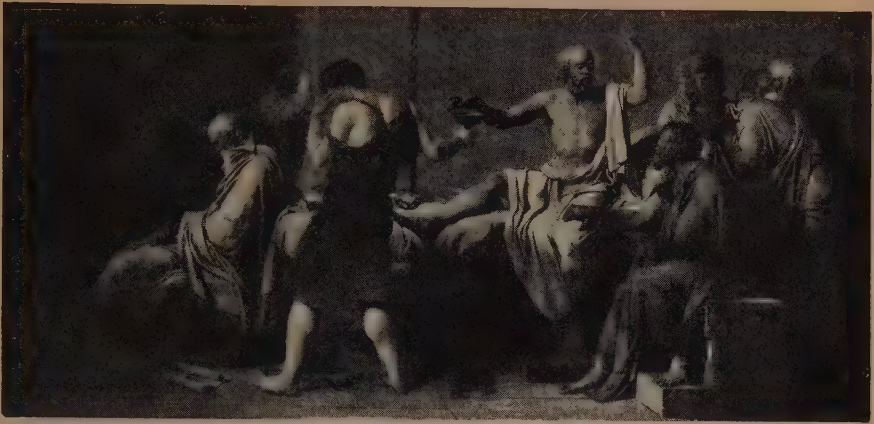
GREEKS WHOSE FAME WILL NEVER DIE

ARISTOTLE IN A THOUGHTFUL MOOD



AN ANCIENT SCULPTURE OF SOCRATES

A FINE BRONZE HEAD OF PLATO



Socrates about to die a martyr's death.

THE IMMORTAL THREE

IN the wonderful story of human adventure there are three names of such power over mankind that they seem to us eternal. These are not the names of great conquerors, powerful kings or bold discoverers of unknown lands, but the names of three thinkers—Socrates, Plato and Aristotle. These Greeks, who lived long before Jesus was born, are known in every nation of the world. Universities in all countries are still studying their works. Their immortality is part of the thinking life of the world.

But many people know only their names. They have had no time to study their works. What did they teach? How is it that these names have an eminence beyond that of all other teachers? How is it that there is no thinking man alive who has not heard of these immortal three or does not owe them something? In what way is their immortality a part of our thinking life? Let us see if it is possible to answer these questions with a simplicity which any intelligent person can understand.

One day when the Greek army was in camp a soldier who was popular with his comrades for cheerfulness and a joking courage found himself suddenly rooted to the ground. He had fallen in a trance, and so he remained for twenty-four hours. When he came out of it, although he was still loved for his genial good nature, he was marvelously changed. This soldier was a stone mason, and his name was Socrates. He was broad-shouldered, deep-chested and strong-legged, with a face so funny in its ugliness and a head so huge for his body, that he was an object of friendly ridicule for other soldiers. They loved him; they admired him; they knew he was as brave and as strong as the best of them; but they could not help regarding him as an oddity.

He told men that the gods to whom they prayed were not worth a thought, that they had indeed been created by men like themselves; whereas there was something in the universe really deserving of man's adoration—something infinitely higher, grander and more inspiring than anything on earth, and that was God.

This divine Being, said Socrates, was not, like the gods of the ancient world, of violent passions and brutal strength, always blustering, threatening and interfering in human affairs: He was spirit. Men might call Him

Truth, or Beauty, or Goodness; but no name could explain Him. Perhaps the simplest way of thinking of Him was to know that He represented Perfection. Mankind sees beauty on the earth, but it is an imperfect beauty. God is the perfection of all beauty. People see goodness here, and truth, but they are imperfect. God is the perfection of all truth and goodness.

As this wonderful God is the creator of the universe, as it is His spirit which governs all things, the wise man, said Socrates, would see that there could be no happiness in life greater than communion with God. Hence the wise man must think about truth, beauty and goodness. A wise man, in the idea of Socrates, does not try to make money, or dream of wearing fine clothes, or long to dwell in a big house. All those things will seem paltry and trivial in his eyes. What he desires, above and beyond everything else in human life, is a sense of the presence of God in his soul. Therefore he will think about God. God will become the master-thought of his mind. His spirit will become familiar with God before it leaves the body to dwell with Him in the real world that lies beyond our world of shadows.

THE TALK OF SOCRATES AS HE WALKED THROUGH ATHENS

Socrates did not preach. He did not even set up a school in which to teach his new ideas. He merely walked barefooted about Athens talking of these things to anyone who would discuss them. But his conversation was so witty and amusing, his character was so noble and lovable, that people of all classes flocked to him for knowledge. He was soon the greatest power in Athens. Then the priests frowned on him, and teachers of philosophy attacked him.

Thus Socrates was urged forward to another step in his revelation. It was a great thing to make men think of God as the invisible Perfection of the universe. It was a great thing to make them realize that to think about this Perfection was the chief end of human life; but something else remained to be done.

First there was the criticism of the priests. Who was this Socrates, telling them that the ancient gods were unworthy of worship? Who was this upstart to teach them what truth is? And there were the philosophers, who believed that they could guess how the world was made and explain to men the whole history of creation. These philosophers would have nothing to do with what Socrates called his "revelations." They wanted to *know*. How was the world made? Why was it made? What is nature? What is life?

THE DIVINE RIGHT OF REASON IN THE THINGS OF THE SOUL

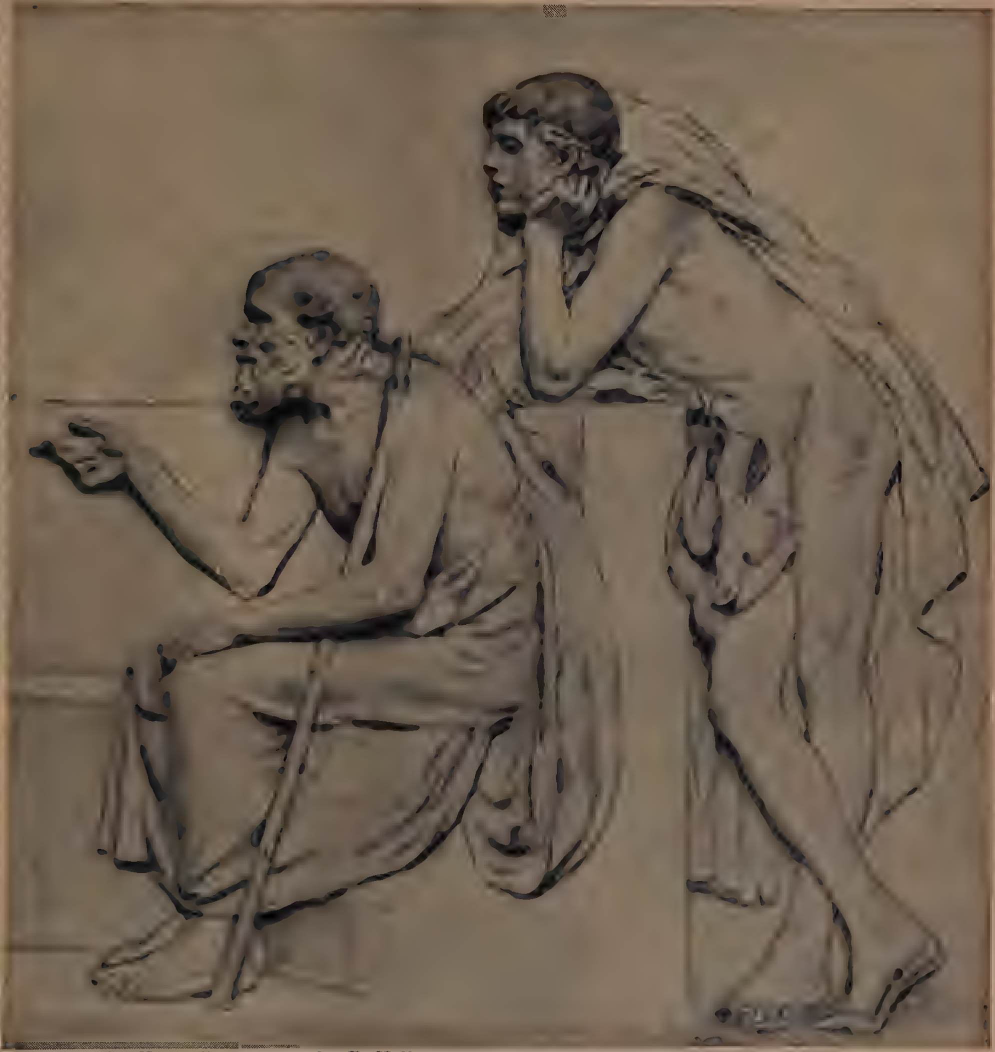
Socrates had a wonderful answer both for the priests and for the philosophers. He claimed the sovereign right of *reason* to decide these matters. It was a tremendous claim; eventually it brought him to a martyr's death. He said that man could trust his reason; that his reason was divine; and that by the use of his reason man might approach God. If his reason told him certain gods were false, how could he worship them? What men believed in the past must not be allowed to bind men in the present. Reason must decide their beliefs.

But the philosophers, he said, were using their reason in a foolish fashion. There is a right way and a wrong way of reasoning. He said he could prove by reason that the reasoning of the philosophers was false. He then began to question the philosophers and soon showed that they were talking nonsense. His questions are still the delight of the world. He could make the most eminent philosophers contradict themselves. He could cover the dogmatists with ridicule.

He made it clear that the mind can be deceived by the senses and also by words. People allow their eyes to deceive them. They think they see all there is to be seen, but the invisible is greater than the visible, and what we see of the visible is not all there is to be seen even of that. As for words, men use them as if they were things; they get used to the word and fail to see the miracle of the thing the word stands for. Let them stop to think about words and they will soon see how little they know.

THE QUESTIONS THAT MEN SHOULD BE ASKING THEMSELVES

Socrates told men that they must be honest. They must question themselves. They must develop conscience. They must always be asking themselves, Do I really believe this or that? and What does this word or that word really mean? Let them get into this habit of being honest with themselves and they would soon find how little they knew, and how fitting it was that they should be modest before other men and humble in the presence of Eternal Wisdom.



Sculpture by Harry Bates, photo by F. Hollyer.

SOCRATES TALKING ON ETERNAL JUSTICE AND EVERLASTING LIFE

In one of the most memorable pictures in literature we read how sublimely this noble spirit met a martyr's death when his enemies brought him to judgment. He might have escaped, but he preferred to die; and when one of his friends asked how he would like to be buried he replied, with a smile: "Just as you please, *if only you can catch me.*"

Among those who listened to Socrates, and came to him, was a handsome and aristocratic youth named Plato. After the death of Socrates Plato took refuge in a town named Megara, where he met Euclid. Afterward he went to Egypt and studied geometry, and to southern Italy, where he studied moral philosophy. He was forty when he returned to Athens and set up, in the groves of an ancient hero named Academus, a school of philosophy, from which we get our word "academy." He was a splendid figure; he had dignified and charming manners; and he was a passionate lover of wisdom.

Plato is one of the greatest men that ever lived. Some think he stands in solitary eminence high above all the sons of men. Undoubtedly he has exercised an influence on human life which cannot be exaggerated.

But it must be said of him that he lacked the moral splendor of Socrates. Not for him the coarse garment, the hermit's meal, the rigorous honesty of his master. What Socrates preached Socrates practiced. Sincerity was the very centre of his soul. He was something of a Puritan. He has even been likened to Jesus.

But Plato was of a very different disposition. He was, above all else, an artist. To him the whole beauty of life lay in *expression*. He wrote beautifully, and we can feel as we read him how he must have loved composing his books, leading quietly up from the simple words we use in conversation to such magnificent periods as seem to bring all heaven about our souls. It may be said that for Plato life itself was an art, and that he sought wisdom because of his passion to live beautifully.

It is chiefly from Plato that we learn what Socrates taught, for Socrates never wrote a line. But Plato developed the glorious simplicity of Socrates' ideas and wove them into a philosophy. Anyone can understand what Socrates taught, but it takes a philosopher to understand Plato. He preserves the simplicity of Socrates as his starting-point; but from that plain point he sets off on a journey which carries the simple mind beyond its understanding. Wonderful is the lofty genius of Plato, but when we have closed his works we may truly say that the soul of his philosophy is the simplicity of Socrates. This philosophy, in a few words, is this—that the visible is only a shadow of the invisible, and that communion with God is the highest state of bliss possible to the human soul.

We can best understand the genius of Plato by finding out what opinions he sought to overthrow in Athens. What was the old idea he attacked in order to set up a new one? It was generally held that man is nothing more than a piece of mechanism which receives sensations. When it is hot we know by our sensations that it is hot; when it is cold we know by our sensations that it is cold. When we see a horse or a tree or a star it is by the sensations aroused by these things that we know them for horse, tree or star. In other words, man is an animal.

THE BELIEFS THAT PLATO DESTROYED WITH HIS PITILESS LOGIC

Plato examined this doctrine and utterly destroyed it by his logic. He said that we do indeed receive impressions of things, as other animals do, but that we distinguish between them. All horses make the same impression on us, but we distinguish between a black horse and a white horse, between a beautiful and an ugly horse. When color makes its impression on our senses we distinguish between green and yellow, blue and red.

But our sensations are only a part of our knowledge. The soul of our knowledge is the idea we form in our minds from the sensations. Suppose we hear a hideous noise. The sensation we receive is not hideous or sweet; it is simply a sensation of sound. The ear takes in waves of air, and we call it sound. But something within us is not content to call that sensation sound; it says: "This sound is hideous; it is discordant; it is wrong." And then other sounds enter the ear and this something within us says: "These sounds are beautiful; they are harmonious; they are right."

Now, what would happen to us if we were robbed of this power to form ideas? We should simply receive impressions. We should know nothing of the various objects from which we received those impressions. We should have no *ideas*.

Plato suggested one particular idea, of which we are now only beginning to perceive the magnitude. He said that man's mind had invented the language of geometry, that geometry has nothing whatever to do with sensation, and that by means of geometrical reasoning man is able to explore the universe and discover its invisible laws. Where did it come from, this marvelous idea of geometry?

As Plato had been a disciple of Socrates and developed his master's teaching, so Aristotle was a disciple of Plato, and likewise developed his master's teaching. Aristotle came to Athens from Macedon, and lived for a little while the life of a young man of fashion. Coming under the influence of Plato, he soon abandoned all trivial self-indulgence, became a passionate seeker after truth, married a woman he loved with all his heart, and lived one of the happiest domestic lives of which we have any record.

We know that he was a little man, with a thin, feminine voice, and that he was so delicately constituted that while he was lecturing he had to walk about in order to exercise his body. We also know that he was gentle, modest and kind. He was neither a hermit like Socrates nor a man of luxury like Plato, but a domestic man of simple tastes and quiet dignity.

Aristotle believed many things that Plato believed, but he differed from his master is one all-important thing. Plato speculated about the mystery of the universe. Aristotle examined that mystery with eyes and hands.

He was the first naturalist, the first man of science. He felt that it was not enough to *think* about how the world was made, or how the mind gets its knowledge. He took the body of a dead animal and examined its structure. He set a hen on an egg and examined the egg as it turned into a chicken. He dissected fishes and birds. He collected plants and observed their growth. He consulted with hunters about the habits of animals, and with travelers about different countries and climates. He bought all the old books he could find and searched them for definite knowledge of physical things.

All this was something entirely new in Athens. Plato frowned on his brilliant student. It seemed to him the mark of an inferior mind to read books. Aristotle could not be an original genius if he had to read for ideas instead of getting them out of his own mind. As for going down to quays to talk to fishermen, travelers and hunters, surely it was a vulgar thing to do. As for collecting birds, beasts and insects, as for examining skeletons, surely this was turning knowledge to the basest of ends.

But Aristotle was a genius, if ever a genius lived, and something told him that he was on a road which would lead mankind not only to true knowledge, but to great power. When he came to oppose Plato it was only because truth commanded his soul. He said that all personal feelings must be put aside: Plato was very dear to him, but truth was even dearer. It was a sacred duty to defend truth.

THE TWO MEN WHO DIVIDED THE WORLD INTO TWO CAMPS

There were other ways in which these two men were at variance; but here we have the centre of their difference—a difference destined to divide the whole world into two camps. Plato's influence passed into religion. The influence of Aristotle, after having inspired the religion of the Arabs, and after having helped to shape the early Christian Church, passed out of all religious keeping and became the inspiration of modern science.

In many of his conclusions Aristotle was wrong, but he did a work of infinite importance for mankind in bringing into existence the notion of a universal law governing all things. He saw the order, the harmony and the beauty of the universe as an expression of the Will of God. Human life was not at the sport of gods and demons. A man might stand upright and fearless on the earth, knowing that the structure of the universe surrounding him was the work of a great Intelligence. Things did not happen by chance. There was no caprice in the universe. Law reigned everywhere. Let a man not cower beneath the heavens. Let him not dwell with fear in his soul. Let him seek out knowledge in the facts of the world, and trust to Truth.

To this very day the works of Aristotle are consulted by the chief scholars in Europe, and many hold that his was the greatest mind that has ever existed. Even though his observations were sometimes untrustworthy, and his inferences far-fetched and fantastic, he at least had the curiosity of mind and the desire to know the truth upon which all science is based. He was not content with current theories and explanations; he was ever questioning, examining and inquiring. His scientific methods were perhaps faulty and lacking in precision, but his scientific ardor was altogether admirable, and his classification of animals and plants may be regarded as the beginning of systematic zoölogy and biology, and marks an epoch in the development of both sciences. He was a great scientific pioneer blazing a path through the jungles of ignorance.

THE INVISIBLE WORLD OF THE ATOM WHICH SCIENCE IS NOW EXPLORING

But a new era has now dawned. Science, using the method of Aristotle, has found itself exploring an invisible world. Instead of watching the habits of birds, beasts, fishes, insects and plants, science is now exploring the invisible electric forces which compose the atom, and laying hands on the invisible and atomless stuff of the universe which we call the ether. It is Aristotle's method, not Plato's; but the method of Aristotle has led even physical science into a region in which we feel the spirit of Plato moving forward. We follow Aristotle and discover Plato once more.

So it comes about that we now look back with fresh interest and a new gratitude to the three greatest figures in the golden days of Athens, and marvel that so long ago they should have set us on the road which leads to a true understanding of the universe.

Socrates teaches us never to dogmatize, never to pretend, never to be false. He teaches us to be on our guard against self-deception. We must constantly examine our minds and our souls. Do we love goodness? Are we quite sure about that? How are we living? What are the things we like most? Do we truly long for truth and wisdom? Let us stop ourselves again and again, in our speech and in our actions, to be sure that words or things are not deceiving us. Do we long for wisdom? Then how are we living? There are only two things of which we can be perfectly sure—the existence of God and the existence of our own souls. Therefore let us care for our souls.

THE REAL WORLD OF THE SOUL IS THE WORLD OF IDEAS

Plato teaches us that every form of materialism is absurd. The material world is only a shadow, a dream-world, in relation to the soul. The real world of the soul is the world of ideas. We deceive ourselves when we think about things. It is not the things that are important, but the invisible idea behind them. God is not far off, or indifferent. He is everywhere. We dwell in Him. We are a part of Him. We can come into intimate communion with Him by desiring perfection. "Trees and fields tell me nothing," said Plato; "men are my teachers." He makes us feel the glory of the human soul and the dignity of reason. Virtue is the law of our being.

Plato was one of the greatest writers in the world, and as long as men read at all, his works, in spite of many errors, will remain among the masterpieces of the human mind. But original as were many of his speculations, the roots of all of them can be traced back to the philosophers who went before him; so that, vast and immortal as were his achievements, we do not feel that he blazed a path for the human mind in quite the same way as Aristotle did.

Plato developed the teaching of Socrates. He taught men that the senses can never give them a true notion of reality. He made them realize that in all they can see with human eyes there is an invisible truth which no words can define. He brought home to men the thought of a divinity in the universe, the feeling of a divinity in their own souls, and encouraged them to dwell on this thought and make it the centre of their lives by meditation, wonder and adoration.

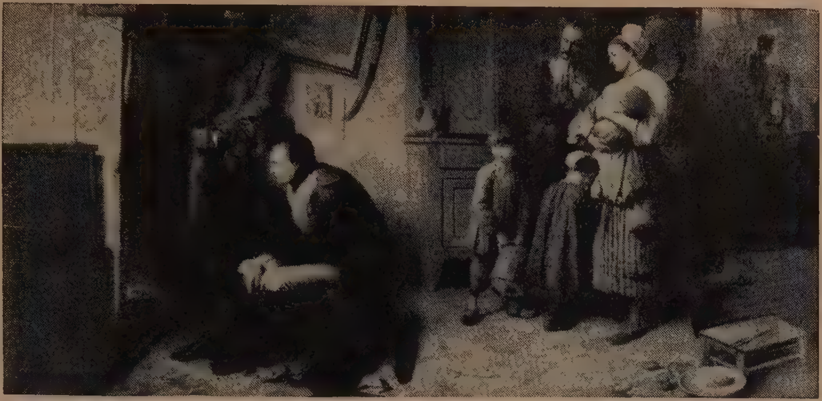
Aristotle listened to Plato for many years. He did not disagree with him on the central truth of his teaching. He, too, believed in God; he, too, was ready to confess that behind all shapes and forms there is a divine reality. But he came to think that men might better approach to some knowledge of this reality by observation and experiment than by meditation.

Aristotle teaches us, above and beyond everything else, to *observe*. Trees and fields do indeed tell nothing to a man who looks at them superficially. Looking at them with open eyes and understanding, and seeking to know how the grass grows and how the trees put forth fresh leaves in spring, will teach us the laws of God. It is not enough for us to sit with folded hands and closed eyes meditating on the thought of God. It is not enough for us to speculate on the divine mystery and say: Thus and thus have things come to pass. We must tear open the earth to discover its secrets; we must wrest from nature ever fresh power to extend our dominion; we must search and grope for additions to our knowledge; we must be content with nothing short of Truth.

THREE MEN OF THE OLD WORLD WHO INFLUENCE OUR LIVES TO-DAY

So it is that these three men enter into every part of our thinking life, and become in us one single influence making for the fulfillment of God's will upon earth. To be worthy of this duty, which none of us can escape, we must follow where they lead us. We must be as honest as Socrates, as spiritual as Plato, as intellectual as Aristotle. We must do all that in us lies to develop that inner life.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6133.



THE GRANDMOTHER'S TALE

PIERRE JEAN DE BERANGER was the greatest song-writer of France. He was born in 1780 and died in 1857, so that he lived through the most exciting periods of French history. As a song-writer for the people he is akin to Burns.

HIS fame shall never pass away!
Beside the cottage hearth the hind
No other theme shall list to find
For many and many a distant day.
When winter nights their gloom begin,
And winter embers ruddy glow,
Round some old gossip closing in,
They'll beg a tale of long ago—
"For all," they'll say, "he wrought us ill,
His glorious name shall ne'er grow dim,
The people love, yes, love him still,
So, grandmother, a tale of him,
A tale of him!"

"One day past here I saw him ride,
A caravan of kings behind;
The time I well can call to mind,
I hadn't then been long a bride.
I gazed out from the open door,
Slowly his charger came this way;
A little hat, I think, he wore,
Yes, and his riding coat was gray.
I shook all over as quite near,
Close to this very door he drew—
'Good-day,' he cried, 'good-day, my dear!'"
"What, grandmother, he spoke to you,
He spoke to you?"

"The following year I chanced to be
In Paris; every street was gay,
He'd gone to Notre Dame to pray,
And passed again quite close to me!
The sun shone out in all its pride,
With triumph every bosom swelled;
'Ah, what a glorious scene!' they cried,
'Never has France the like beheld!'
A smile his features seemed to wear,
As on the crowds his glance he threw,
For he'd an heir, at last, an heir!"—
"Ah, grandmother, what times for you,
What times for you!"

"Then came for France that dreadful day
When foes swept over all the land;
Undaunted he alone made stand,
As tho' to keep the world at bay!
One winter's night, as this might be,
I heard a knocking at the door;
I opened it; great heavens! 'twas he!
A couple in his wake—no more;
Then sinking down upon a seat—
Ay, 'twas upon this very chair,
He gasped: 'Defeat! Ah, God, defeat!'"
"What, grandmother, he sat down there,
He sat down there?"

"He called for food; I quickly brought
The best I happened to have by;
Then when his dripping clothes were dry,
He seemed to doze awhile, methought.
Seeing me weeping when he woke,
'Courage,' he cried, 'there's still a chance;
I go to Paris, one bold stroke,
And Paris shall deliver France!'
He went; the glass I'd seen him hold,
The glass to which his lips he'd set,
I've treasured since like gold, like gold!"
"What, grandmother, you have it yet,
You have it yet?"

"'Tis there. But all, alas! was o'er;
He, whom the Pope himself had crowned,
The mighty hero world-renowned,
Died prisoner on a far-off shore.
For long we none believed the tale,
They said that he would reappear,
Across the seas again would sail,
To fill the universe with fear!
But when we found that he was dead,
When all the shameful truth we knew,
The bitter, bitter tears I shed!"
"Ah, grandmother, God comfort you,
God comfort you!"

THE LAST ROSE OF SUMMER

This little poem, written by the sweet Irish singer Thomas Moore, is one that is widely known and much loved. It has been put to music, and as a song it is very popular.

'TIS the last rose of summer
Left blooming alone;
All her lovely companions
Are faded and gone;
No flower of her kindred,
No rose-bud is nigh,
To reflect back her blushes,
Or give sigh for sigh.

I'll not leave thee, thou lone one!
To pine on the stem;
Since the lovely are sleeping,
Go, sleep thou with them.
Thus kindly I scatter
Thy leaves o'er the bed
Where thy mates of the garden
Lie scentless and dead.

So soon may I follow,
When friendships decay,
And from love's shining circle
The gems drop away.
When true hearts lie withered,
And fond ones are flown,
O! who would inhabit
This bleak world alone?

THE COURTIN'

The following poem, The Courtin', written by James Russell Lowell, tells of a New England courtship in the language of the countryside, and is full of a delicate humor and pathos.

GOD makes sech nights all white an' still
Fur'z you can look or listen,
Moonshine an' snow on field an' hill,
All silence an' all glisten.

Zekle crep' up quite unbeknown
An' peeked in thru' the winder,
An' there sot Huldy all alone,
'Ith no one nigh to hender.

A fireplace filled the room's one side
With half a cord o' wood in—
There warn't no stoves (tell comfort died)
To bake ye to a puddin'.

The wa'nut logs shot sparkles out
Towards the pootiest, bless her,
An' leetle flames danced all about
The chiny on the dresser.

Agin the chimbley crook-necks hung,
An' in amongst 'em rusted
The old queen's-arm thet gran'ther Young
Fetched back from Concord busted.

The very room, coz she was in,
Seemed warm from floor to ceilin',
An' she looked full ez rosy agin
Ez the apples she was peelin'.

'Twas kin' o' kingdom-come to look
On sech a blessed cretur,
A dogrose blushin' to a brook
Ain't modester nor sweeter.

He was six foot o' man, A1,
Clear grit an' human natur';
None couldn't quicker pitch a ton
Nor dror a furrer straighter.

He'd sparked it with full twenty gals,
He'd squired 'em, danced 'em, druv 'em,
Fust this one, an' then thet, by spells—
All is, he couldn't love 'em.

But long o' her his veins 'ould run
All crinkly like curled maple,
The side she breshed felt full o' sun
Ez a south slope in Ap'il.

She thought no v'ice hed sech a swing
Ez hisn in the choir;
My! when he made Ole Hundred ring,
She *knowed* the Lord was nigher.

An' she'd blush scarlit, right in prayer,
When her new meetin'-bonnet
Felt somehow thru' its crown a pair
O' blue eyes sot upon it.

Thet night, I tell ye, she looked *some.*
She seemed to 've gut a new soul,
For she felt sartin-sure he'd come,
Down to her very shoe-sole.

She heered a foot, an' knowed it tu,
A-raspin' on the scraper—
All ways to once her feelin's flew
Like sparks in burnt-up paper.

He kin' o' l'itered on the mat,
Some doubtfle o' the sekle,
His heart kep' goin' pity-pat,
But hern went pity Zekle.

An' yit she gin her cheer a jerk
Ez though she wished him furder,
An' on her apples kep' to work,
Parin' away like murder.

"You want to see my pa, I s'pose?"
"Wal—no—I come dasignin' "—
"To see my ma? She's sprinklin' clo'es
Agin to-morrer's i'nin'."

To say why gals acts so or so,
Or don't, 'ould be presumin';
Mebby to mean *yes* an' say *no*
Comes nateral to women.

He stood a spell on one foot fust,
Then stood a spell on t'other,
An' on which one he felt the wust
He couldn't ha' told ye nuther.

Says he, "I'd better call agin."
Says she, "Think likely, mister."
Thet last word pricked him like a pin,
An'—wal, he up an' kist her.

When ma bimeby upon 'em slips,
Huldy sot pale ez ashes,
All kin' o' smily roun' the lips
An' teary roun' the lashes.

For she was jes' the quiet kind
Whose naturs never vary,
Like streams that keep a summer mind
Snowhid in Jenooary.

The blood clost roun' her heart felt glued
Too tight for all expressin',
Tell mother see how matters stood,
An' gin 'em both her blessin'.

Then her red come back like the tide
Down to the Bay o' Fundy,
An' all I know is they was cried
In meetin' come nex' Sunday.

JUDGE not; the workings of his brain
And of his heart thou canst not see;
What looks to thy dull eyes a stain,
In God's pure light may only be
A scar brought from some well won field
Where thou wouldst only faint and yield.

LITTLE SOPHY BY THE SEASIDE

Charles Tennyson Turner, who wrote this charming sonnet, was the elder brother of Lord Tennyson, and took the name of Turner when he inherited the fortune of a relative.

YOUNG Sophy leads a life without alloy
Of pain; she dances in the stormy air;
While her pink sash and length of golden hair
With answering motion, time her step of joy.

Now turns she through that seaward gate of heaven,
That opens on the sward above the cliff,—
Glancing a moment at each barque and skiff,
Along the roughening waters homeward driven.

Shoreward she hies, her wooden spade in hand,
Straight down to childhood's ancient field of play,
To claim her right of common in the land
Where little edgeless tools make easy way—
A right no cruel Act shall e'er gainsay,
No greed dispute the freedom of the sand.

THE SUN

In the Book of the Earth we are told all about the wonders of the big ball on which we live, and how it is daylight in some places while it is dark in others. In the following verses Thomas Miller expresses the fact in simple words.

SOMEWHERE it is always light,
For when 'tis morning here,
In some far distant land 'tis night,
And the bright moon shines there.

When you're undressed and going to bed,
They are just rising there,
And morning on the hills doth spread
When it is evening here.

And other distant lands there be,
Where it is always night;
For weeks and weeks they never see
The sun, nor have they light.

For it is dark both night and day,
But what's as wondrous quite,
The darkness it doth pass away,
And then for weeks 'tis light.

Yes, while you sleep the sun shines bright,
The sky is blue and clear;
For weeks and weeks there is no night,
But always daylight there.

LIVING for self and thinking of self,
And of nothing on earth beside,
Just as if Jesus had never lived,
And as if He had never died.

—Anon.

BABYLAND*

The poems about the imaginary land where babies live are endless in number and fancy. Mrs. Ella Wheeler Wilcox, an American writer, is true to the old story that the stork knows the way to Babyland, and that it alone can bring babies to the happy-hearted mothers.

HAVE you heard of the Valley of Babyland?
The realm where the dear little darlings stay,
Till the kind storks go, as all men know,
And, oh, so tenderly bring them away;
The paths are winding, and past all finding
By all save the storks, who understand
The gates and the highways and the intricate byways
That lead to Babyland.

All over the Valley of Babyland
Sweet flowers bloom in the soft green moss;
And under the ferns fair, and under the plants there,
Lie little heads like spools of floss.
With a soothing number the river of slumber
Flows o'er a bedway of silver sand;
And angels are keeping watch o'er the sleeping
Babes of Babyland.

The path to the Valley of Babyland
Only the kingly, kind storks know;
If they fly over mountains, or wade through fountains,
No man sees them come or go.
But an angel may be, who guards some baby,
Or a fairy perhaps, with her magic wand,
Brings them straightway to the wonderful gateway
That leads to Babyland.

And there in the Valley of Babyland,
Under the mosses and leaves and ferns,
Like an unfledged starling, they find the darling
For whom the heart of a mother yearns;
And they lift him lightly, and snug him tightly
In feathers soft as a lady's hand;
And off with a rockaway step they walk away
Out of Babyland.

As they go from the Valley of Babyland
Forth into the world of great unrest,
Sometimes in weeping he wakes from sleeping,
Before he reaches the mother's breast.
Ah, how she blesses him, how she caresses him!
Bonniest bird in the bright home band,
That o'er land and water the kind stork brought her
From far-off Babyland.

THERE'S ROOM AT THE TOP

There's Room at the Top was written by Mrs. Lilla T. Elder, an American poet. Mrs. Elder, who had children of her own, so thoroughly understood child nature, that her verses cannot fail to continue to be a great source of delight to boys and girls of all ages. Several of her most charming poems will be found in different parts of the Book of Poetry.

THE hill of success may be steep, boys,
And hard work it may be to climb,
But the way grows smooth towards the top, boys,
And it's only one step at a time!

Be sure you are honestly shod, boys!
Take the staff of Self-help in your hand,
Watch out for the rough, rocky tread, boys,
And trust not to gravel or sand.

Look not far up into the clouds, boys,
Nor yet on the valley below,
But steadfastly, patiently, climb, boys!
Each step of the way learn to know!

Respect well the right of road, boys,
Let others more swift pass you by,
And fail not to hold out a hand, boys,
To all those who stumble and sigh.

There's plenty of room at the top, boys,
Though crowded the pathway and long,
And no one need fail in the end, boys,
If he's honest and patient and strong.

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*From Poems of Pleasure, copyright, 1902, by Ella Wheeler Wilcox. By permission of the publishers, W. B. Conkey Company, Hammond, Indiana.

IN FLANDERS FIELDS*

This poem appeared in the London Punch on December 8, 1915. Before the end of the World War it had become a household word among English-speaking peoples. Its author, Lieutenant-Colonel John McCrae, a Canadian surgeon, died in active service on January 28, 1918.

IN Flanders fields the poppies blow
Between the crosses, row on row,
That mark our place; and in the sky
The larks, still bravely singing, fly
Scarce heard amid the guns below.

We are the Dead. Short days ago
We lived, felt dawn, saw sunset glow,
Loved and were loved, and now we lie,
In Flanders fields.

Take up our quarrel with the foe:
To you from failing hands we throw
The torch; be yours to hold it high.
If ye break faith with us who die
We shall not sleep, though poppies grow
In Flanders fields.

MY HEART SHALL BE THY GARDEN †

Alice Meynell, the author of this poem, was born in London about 1853. She and her husband, Wilfrid Meynell, were benefactors of Francis Thompson, who wrote The Hound of Heaven. Alice Meynell died in 1922.

MY heart shall be thy garden. Come, my own,
Into thy garden; thine be happy hours
Among my fairest thoughts, my tallest flowers,
From root to crowning petal, thine alone.
Thine is the place from where the seeds are sown
Up to the sky inclosed, with all its showers.
But ah, the birds, the birds! Who shall build bowers
To keep these thine? O friend, the birds have flown.

For as these come and go, and quit our pine
To follow the sweet season, or, new-comers,
Sing one song only from our alder-trees,
My heart has thoughts, which, though thine eyes hold mine,
Flit to the silent world and other summers,
With wings that dip beyond the silver seas.

FAITH

Fanny Kemble, the famous English actress, who died in 1893, is the author of this beautiful little poem.

BETTER trust all, and be deceived,
And weep that trust and that deceiving,
Than doubt one heart that, if believed,
Had blessed one's life with true believing.

O, in this mocking world too fast
The doubting fiend o'ertakes our youth!
Better be cheated to the last
Than lose the blessèd hope of truth.

FAREWELL

This graceful yet sad farewell to the sun is from the pen of John Addington Symonds, a poet and able prose writer whose work took a minor tone owing to ill health. In quest of sun and mountain air he passed many years at Davos, in Switzerland, and finally died in Rome, in 1893.

THOU goest; to what distant place
Wilt thou thy sunlight carry?
I stay with cold and clouded face:
How long am I to tarry?
Where'er thou goest morn will be;
Thou leavest night and gloom to me.

The night and gloom I can but take;
I do not grudge thy splendour.
Bid souls of eager men awake;
Be kind and bright and tender.
Give day to other worlds; for me
It must suffice to dream of thee.

DRAKE'S DRUM

This heart-stirring poem by Sir Henry Newbolt, one of the most soundly famous of our modern patriotic poets, is based on the legendary supposition that if the great sea captain should ever be needed by England, in a time of dire extremity, he will be there to help. We take these verses from Poems New and Old, published by John Murray.

DRAKE he's in his hammock an' a thousand mile away,
(Capten, art tha sleepin' there below?),
Slung atween the round shot in Nombre Dios Bay,
An' dreamin' arl the time o' Plymouth Hoe.
Yarnder lumes the Island, yarnder lie the ships,
Wi' sailor lads a dancin' heel-an'-toe,
An' the shore-lights flashin', an' the night-tide dashin',
He sees et arl so plainly as he saw et long ago.

Drake he was a Devon man, an' ruled the Devon seas,
(Capten, art tha sleepin' there below?)
Rovin' tho' his death fell, he went wi' heart at ease,
An' dreamin' arl the time o' Plymouth Hoe.
"Take my drum to England, hang et by the shore,
Strike et when your powder's runnin' low;
If the Dons sight Devon, I'll quit the port o' Heaven,
An' drum them up the Channel as we drummed them long ago."

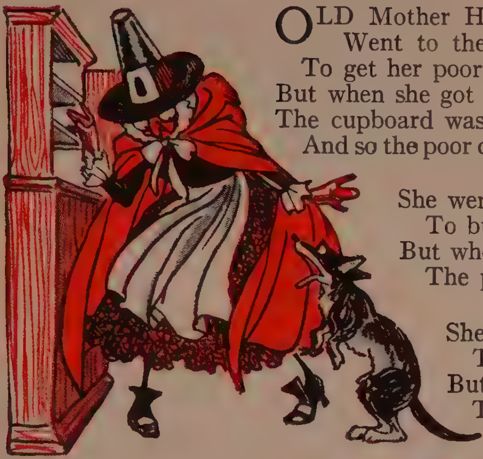
Drake he's in his hammock till the great Armadas come,
(Capten, art tha sleepin' there below?),
Slung atween the round shot, listenin' for the drum,
An' dreamin' arl the time o' Plymouth Hoe.
Call him on the deep sea, call him up the Sound,
Call him when ye sail to meet the foe;
Where the old trade's plyin' an' the old flag flyin'
They shall find him ware an' wakin', as they found him long ago!

---

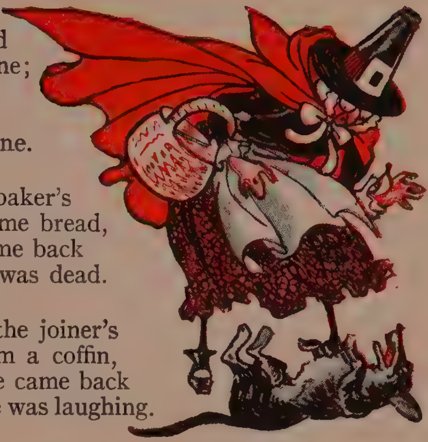
* From In Flanders Fields, by John McCrae; courtesy of G. P. Putnam's Sons, publishers, New York and London.

† From Poems of Alice Meynell, copyright, 1923, by Wilfrid Meynell; published by Charles Scribner's Sons. By permission of the publishers.

OLD MOTHER HUBBARD



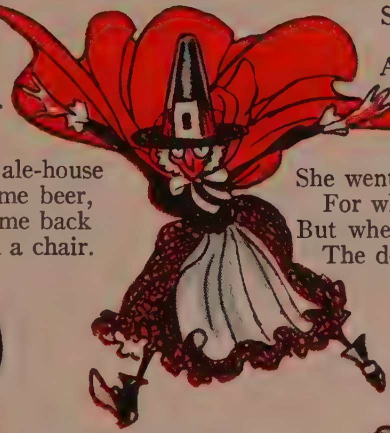
OLD Mother Hubbard
Went to the cupboard
To get her poor dog a bone;
But when she got there
The cupboard was bare,
And so the poor dog had none.



She went to the baker's
To buy him some bread,
But when she came back
The poor dog was dead.

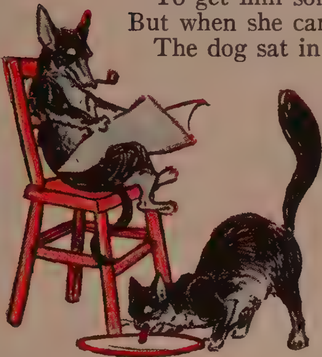
She went to the joiner's
To buy him a coffin,
But when she came back
The dog he was laughing.

She took a clean dish
To get him some tripe,
But when she came back
He was smoking his pipe.

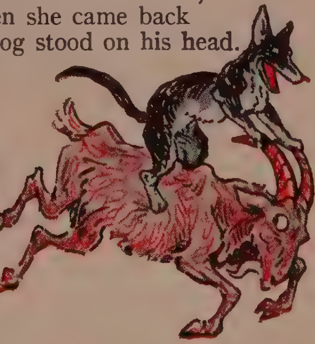


She went to the fishmonger's
To buy him some fish
And when she came back
He was licking the dish.

She went to the ale-house
To get him some beer,
But when she came back
The dog sat in a chair.



She went to the tavern
For white wine and red,
But when she came back
The dog stood on his head.



She went to the hatter's
To buy him a hat,
And when she came back
He was feeding the cat.

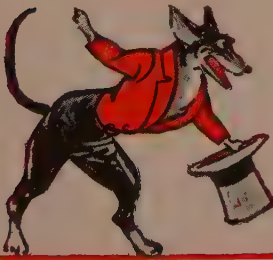
She went to the barber's
To buy him a wig,
But when she came back
He was dancing a jig.

She went to the fruiterer's
To buy him some fruit,
But when she came back
He was playing the flute.

She went to the tailor's
To buy him a coat,
But when she came back
He was riding a goat.

She went to the cobbler's
To buy him some shoes,
But when she came back
He was reading the news.

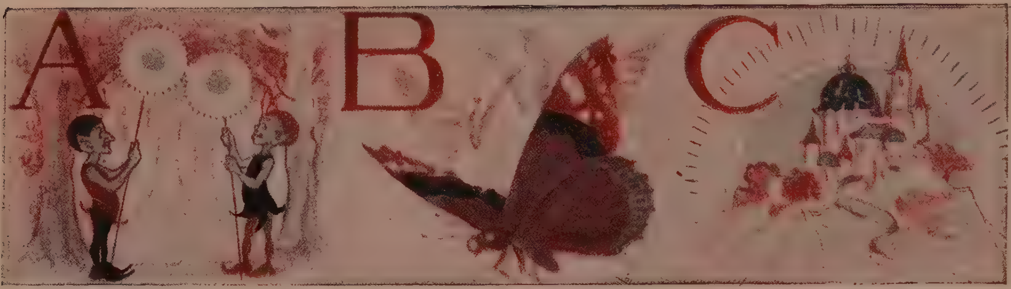
She went to the sempster's
To buy him some linen,
But when she came back
The dog he was spinning.



She went to the hosier's
To buy him some hose,
But when she came back
He was dressed in his clothes.

The dame made a curtsey,
The dog made a bow;
The dame said, "Your servant,"
The dog said, "Bow-wow!"

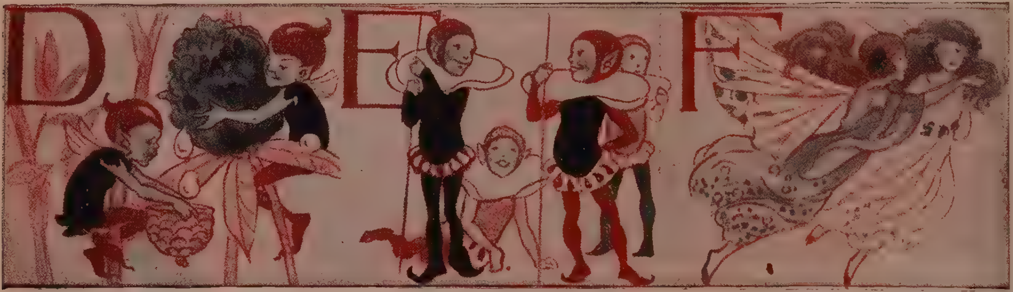
A IS AN ARCHWAY TO FAIRYLAND GAY



A is an ARCHWAY
to Fairyland gay

B for the BUTTERFLIES
showing the way

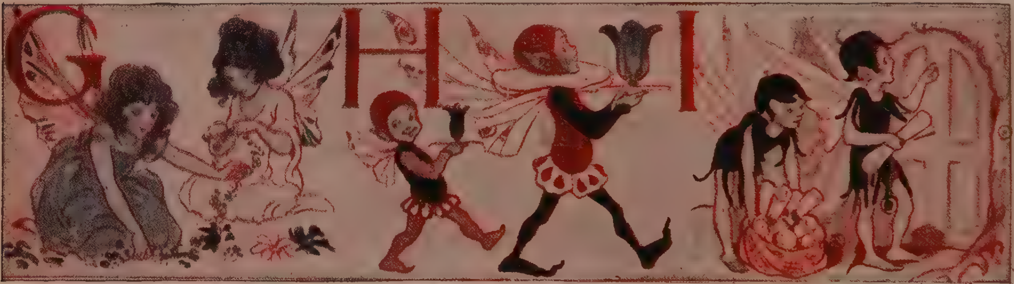
C is the CASTLE
the queen reigns over



D is the DEW
that's brought from the clover

E the ELF–PAGES
surrounding her hall

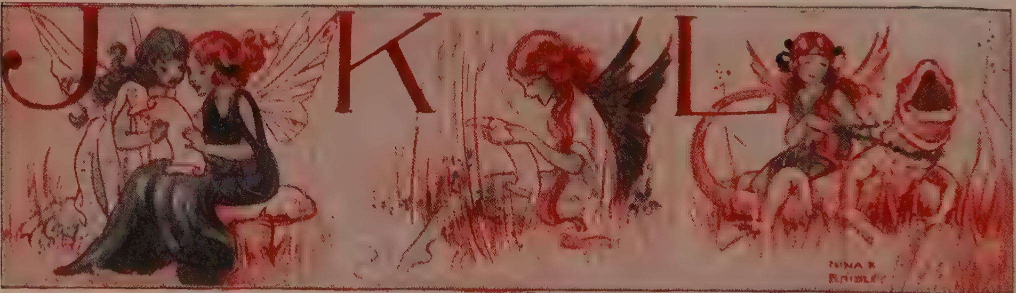
F for the FAIRIES
that fly to her call



G for the GARLANDS
they weave for her hair

H for the HONEY
they bring to her there

I, INVITATIONS
she sends to a ball



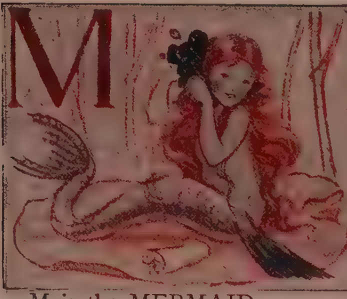
J is the JOY
that they give to them all

K is the KELPIE
who reads hers with pride

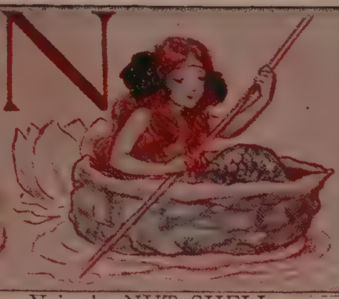
L for the LIZARD
who offers a ride

a b c d e f g h i j k l m n o p q r s t u v w x y z

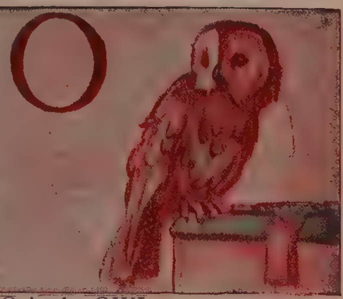
B FOR THE BUTTERFLIES SHOWING THE WAY



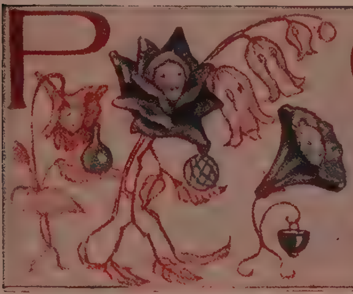
M is the MERMAID
who lives in the moat



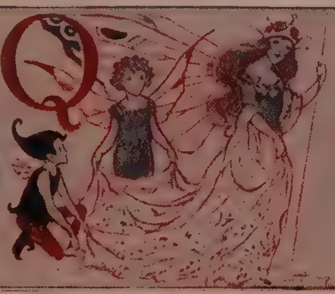
N is the NUT-SHELL
she has for a boat



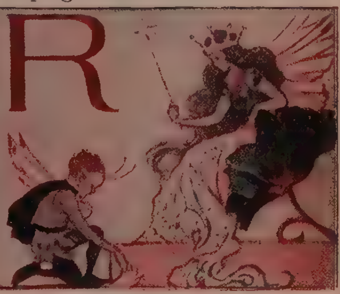
O is the OWL
keeping watch from the tower



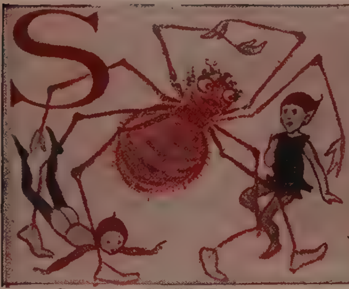
P for the PERFUME
brought in by each flower



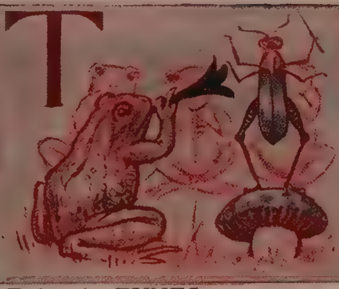
Q is the QUEEN
who is gracious and fair



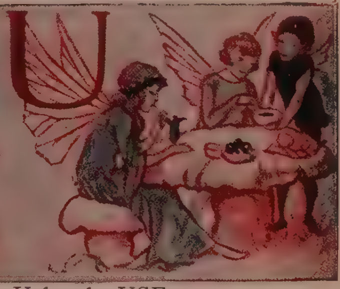
R the RESPECT
that she gains everywhere



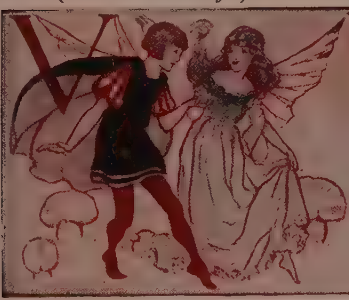
S is the SPIDER
(a bit in the way!)



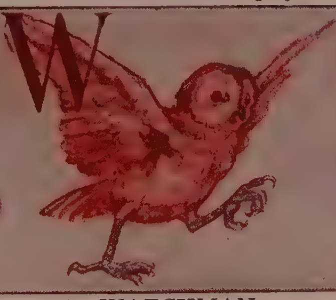
T for the TUNES
when the band starts to play



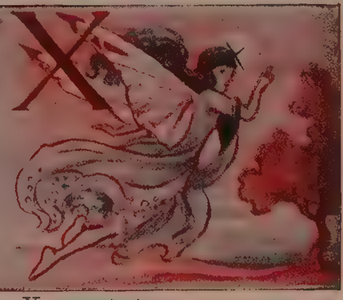
U for the USE
that is made of each chance



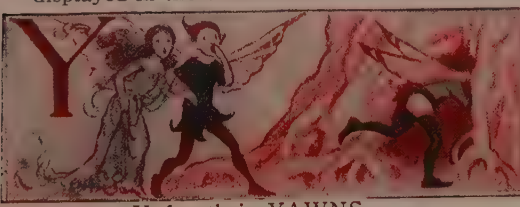
V for the VIGOR
displayed in the dance



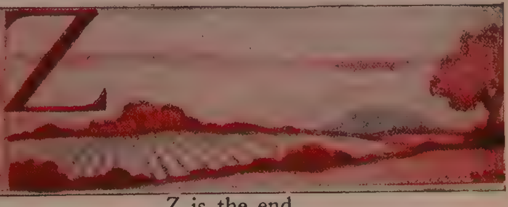
W the WATCHMAN
who comes with a warning



X cannot stop,
for the day is near dawning

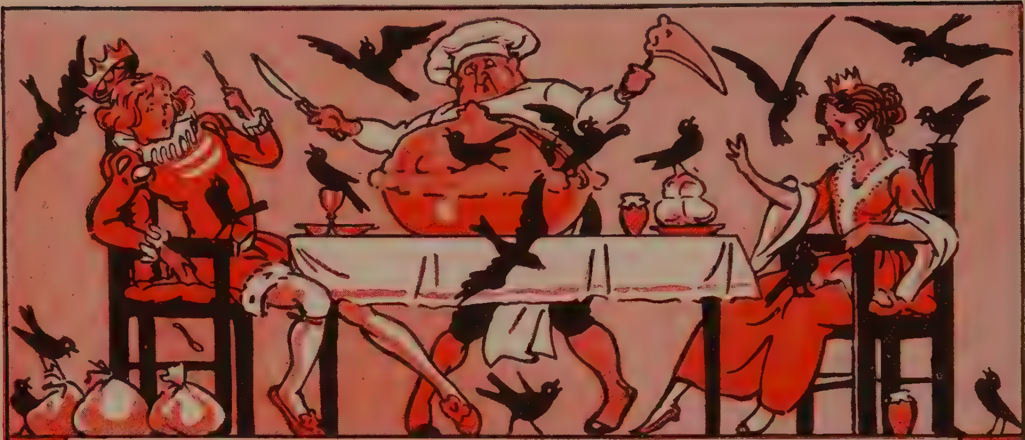


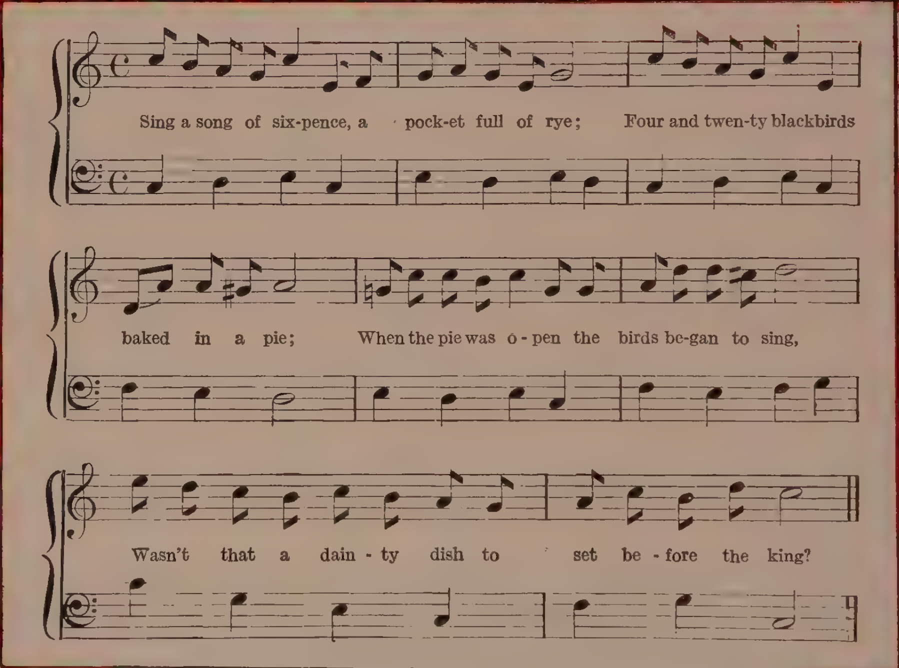
Y for their YAWNS
as they scamper from sight



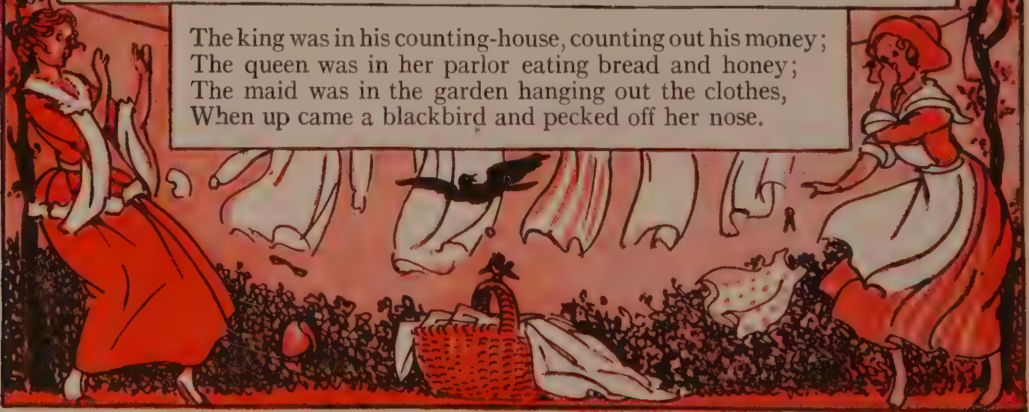
Z is the end
of a beautiful night

A SONG OF SIXPENCE



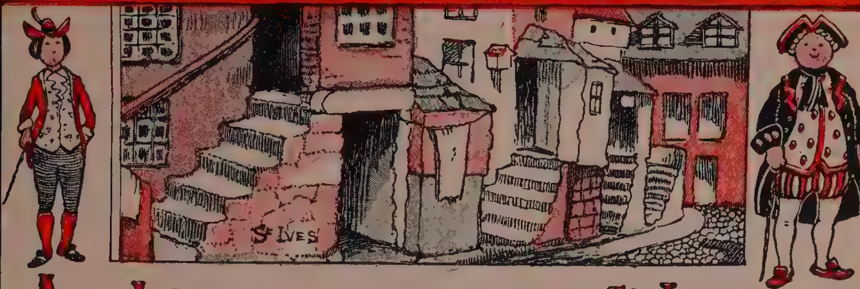

Sing a song of six-pence, a pock-et full of rye; Four and twen-ty blackbirds
baked in a pie; When the pie was o-pen the birds be-gan to sing,
Wasn't that a dain-ty dish to set be-fore the king?

The king was in his counting-house, counting out his money;
The queen was in her parlor eating bread and honey;
The maid was in the garden hanging out the clothes,
When up came a blackbird and pecked off her nose.



NOTE—But a little Jenny Wren came and popped it on again.

LITTLE·VERSES·FOR·VERY·LITTLE·PEOPLE·



As I was going to St. Ives
I met a man with seven wives;

Every wife had seven sacks,

Every sack had seven cats;

Every cat had seven kits:

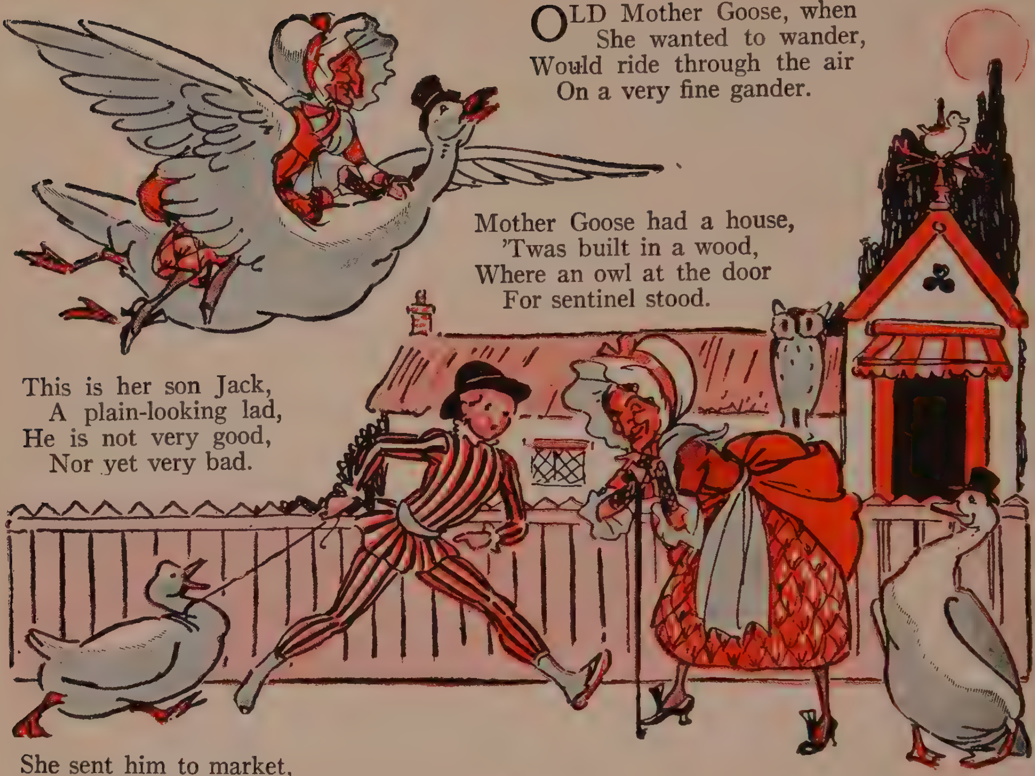
Kits, cats, sacks, and wives,

How many were there going
to St. Ives? ? ? ?

S C Burnside

OLD MOTHER GOOSE

OLD Mother Goose, when
She wanted to wander,
Would ride through the air
On a very fine gander.

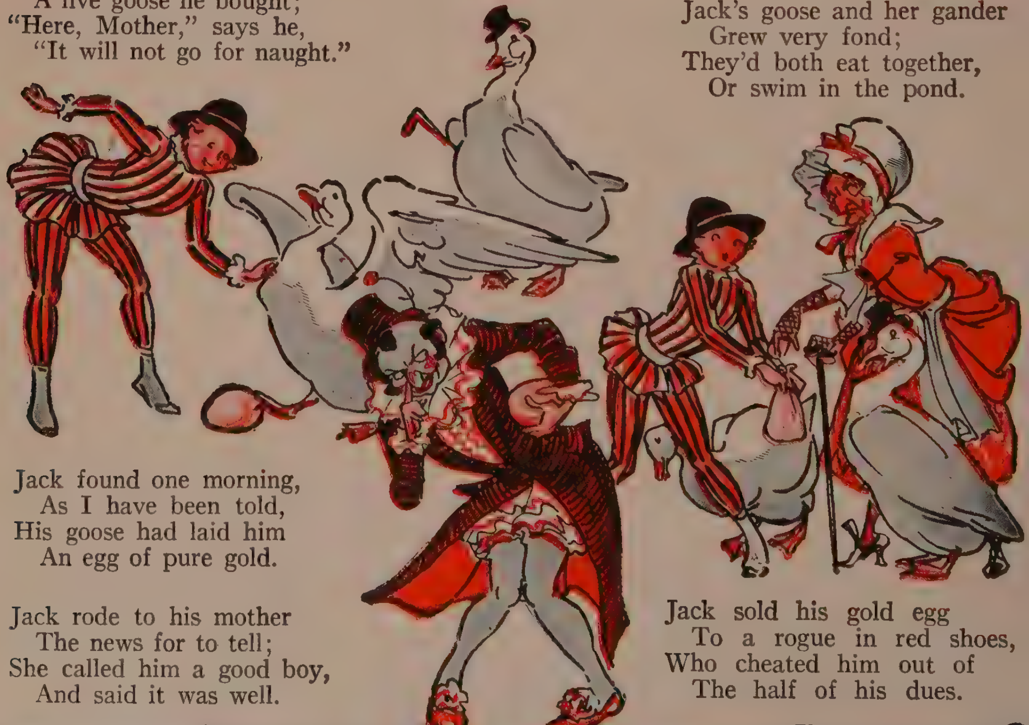


Mother Goose had a house,
'Twas built in a wood,
Where an owl at the door
For sentinel stood.

This is her son Jack,
A plain-looking lad,
He is not very good,
Nor yet very bad.

She sent him to market,
A live goose he bought;
"Here, Mother," says he,
"It will not go for naught."

Jack's goose and her gander
Grew very fond;
They'd both eat together,
Or swim in the pond.

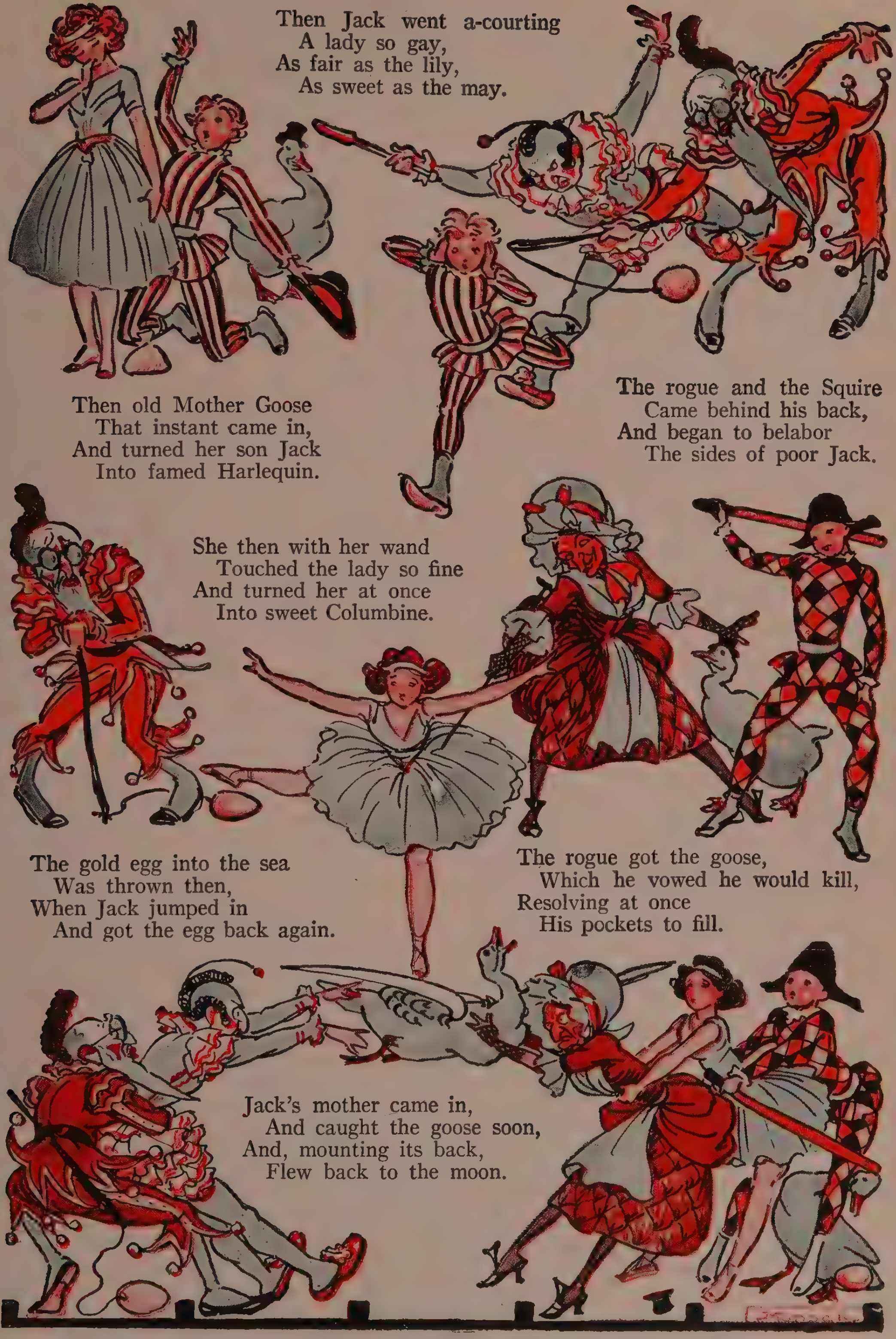


Jack found one morning,
As I have been told,
His goose had laid him
An egg of pure gold.

Jack rode to his mother
The news for to tell;
She called him a good boy,
And said it was well.

Jack sold his gold egg
To a rogue in red shoes,
Who cheated him out of
The half of his dues.

AND HER GANDER



Then Jack went a-courting
  A lady so gay,
As fair as the lily,
  As sweet as the may.

Then old Mother Goose
  That instant came in,
And turned her son Jack
  Into famed Harlequin.

The rogue and the Squire
  Came behind his back,
And began to belabor
  The sides of poor Jack.

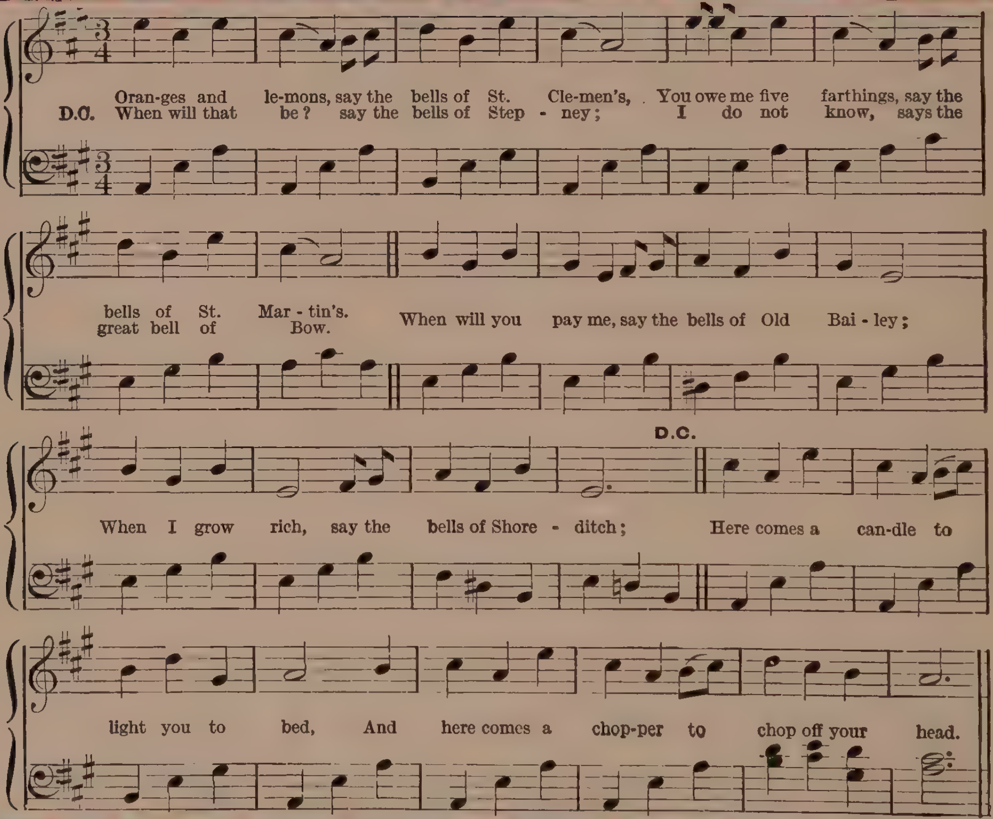
She then with her wand
  Touched the lady so fine
And turned her at once
  Into sweet Columbine.

The gold egg into the sea
  Was thrown then,
When Jack jumped in
  And got the egg back again.

The rogue got the goose,
  Which he vowed he would kill,
Resolving at once
  His pockets to fill.

Jack's mother came in,
  And caught the goose soon,
And, mounting its back,
  Flew back to the moon.

ORANGES AND LEMONS


D.C.
Oran-ges and le-mons, say the bells of St. Cle-men's, You owe me five farthings, say the bells of St. Mar - tin's.
When will that be? say the bells of Step - ney; I do not know, says the great bell of Bow.
When will you pay me, say the bells of Old Bai - ley;
When I grow rich, say the bells of Shore - ditch;
D.C.
Here comes a can-dle to light you to bed, And here comes a chop-per to chop off your head.

The Bourse, the stock exchange of Paris.

VALUE, SUPPLY AND DEMAND

WE should all understand clearly what we mean by Value. In common language value means worth. We have already noticed, however, that the same thing may be valuable at one place and worthless in another. Sand, for example, is valuable to the builder who wants to mix it with lime to make mortar, but it is worse than useless in the desert, where the traveler finds a good deal too much of it. Most things have value in use at some time or place. Water has value in use when we drink it, or when we cook with it, or when we bathe in it, or when, falling as rain on the soil, it gives life to plants. On the other hand, water in the wrong place may be worse than useless to us, as when it leaks through a roof, or comes as a disastrous flood.

When we speak of value in economics, however, we refer, not to value in use, but to Value in Exchange. A thing which is valuable in use often, but not always, has value in exchange. That we saw when we talked about wealth. For example, sunlight is so valuable in use that it is the first necessity of existence, but it has no value in exchange because it is unlimited in supply. This is not quite true in every case. In a city an apartment may bring a higher rental because it has plenty of sunlight. On the other hand, worthless books may be published and have value in exchange because they find buyers.

The invention and use of money enabled us to measure the exchange value of all things by the measure of value we call Price, and when people commonly talk of value they mean price.

Price is the amount of money we give for a thing. Thus it may be said that a large loaf of bread costs about 12 cents, a pound of potatoes about 3 cents, and a pound of rice about 10 cents. Here we see the value in exchange of different things measured in one thing—money. This is very convenient, because it enables us to judge of the relative values of the three things to us. We know that with a quarter we can buy either two loaves of bread at 12 cents, eight pounds of potatoes at 3 cents a pound, or two and a half pounds of rice at 10 cents.

So we can make up our minds what to do with the money we have. Price, being Value in Exchange expressed in money, is thus a very good guide.

From time to time the prices of things vary. Sometimes they vary very much indeed, as, for example, during the World War and after it, when they rose very greatly, or when, afterward, some of the high prices suddenly tumbled down again. Let us see what it is that makes prices, or money values, rise and fall. This brings us to the laws of Supply and Demand.

Demand and Supply are two forces which work on each other in ways which it is very important to understand.

By Demand we mean the desire to possess a thing combined with the ability to buy it and the willingness to buy it.

Tom Brown, on his way home from school, looking into the window of the candy store and seeing some nice chocolates, may desire to have them, but that desire is not "demand" unless he has the money to buy, and unless, also, he is willing to buy at not more than a certain price. We see that demand in the economic sense has no meaning apart from the question of price. Suppose that Tom had 10 cents to spend, and that the candy he would like to buy is $1.50 a pound. As there are sixteen ounces to the pound, that would mean that the chocolates were priced nearly 10 cents an ounce, and Tom, much as he liked chocolates, would not give his money for only one ounce of them. Therefore, at such a price his desire to buy would not be a demand. If, however, the price were 40 cents a pound, his 10 cents would buy four ounces; that would probably turn his desire into demand, and he would go in and buy them.

HOW THE DEMAND FOR A THING VARIES WITH ITS PRICE

So we see how *demand varies with price*. When price is high, the demand is less than when price is low. We often make up our minds whether to buy this thing or that because of the question of price. Thus, if meat becomes very high in price, people, although they like to eat it, will buy less meat and more bread, because bread is cheaper than meat. Our friend Tom, with 10 cents to spend, may have a number of desires to satisfy. Perhaps if he had money enough to buy them all, he would buy not only candy, but a penknife, a top and a ball. The question of price will help him to make up his mind which of the four things to buy. If he could buy a penknife for 10 cents, he might buy that article instead of candy. If, however, he cannot get a penknife for 10 cents, he might spend the money on a top, or, if a good top cannot be bought for 10 cents, he might buy a foreign stamp, or some candy. Tom, as a buyer, would be guided in the exercise of his demand by price.

No one has an unlimited amount of money to spend on any particular thing. In practice people want many things, but have money enough only for some of them. Their desire to buy, their ability to buy, and their willingness to buy, vary according to their needs and according to the price. If a thing gets more expensive, they buy less of it. If a thing gets cheaper, they buy more of it until they satisfy their need for it.

WHY THE DEMAND FOR A THING CHANGES FROM TIME TO TIME

Also we may note that the quantity of a thing which will be bought varies with the need as well as with the price. For example, in the summer people buy less coal than in the winter, while, on the other hand, they buy more ice cream. Umbrellas and overshoes have a ready sale in the winter months, while sunshades and straw hats are in demand in the summer. Changes in demand also occur through sheer fancy, as when it is the fashion for women to dress in velvet or in fur, or to use a particular sort of ornament.

Another interesting thing about demand is that a falling-off in the demand for one thing may be, and often is, accompanied by an increased demand for something else. During the World War, for instance, when butter was very expensive the demand for it fell, and, as a consequence, there was a bigger demand for oleomargarine. Again, the high price of one thing may reduce the price for another thing as well as for itself. Suppose coal-gas became exceedingly expensive. In that case not only the demand for gas would fall off, but also the demand for gas stoves and gas heaters.

THE LUXURIES THAT PEOPLE BUY WHEN THEIR WAGES ARE HIGH

Demand varies greatly with spending power. If Tom has his pocket-money increased, he is able to satisfy more of his wants, and in addition to buying more candy he may make a collection of postage stamps. When wages rise, workmen, in addition to buying food and necessaries, may also buy luxuries, such as musical instruments, or tickets to the theatre or other entertainments.

Now let us turn to Supply. *Supply means the quantity of things that can be sold at a certain price.* The man who has things to sell, whether he be manufacturer or merchant, cannot go on supplying goods at a certain price unless it is profitable for him to do so.

If he makes the goods in his workshop or factory, he has to meet all the expenses of keeping up the building and the machinery, of paying the workmen and foremen their wages, and, in addition, he has to make a margin of profit to form his own income. If he is a merchant or dealer, he has to buy the goods, pay the expenses of placing them in a warehouse or shop, and the wages of the people who help him to sell, and include in his price a margin of profit for himself. In either case we see that the maker or merchant could not go on supplying at less than a certain figure, which is the lowest he can afford to take. The lower he can make his price by using better machinery, or by better organization, or by buying well himself, the more customers he can get.

WHY A NEWSPAPER IS SOLD FOR A FEW CENTS

Perhaps by producing on a larger scale he may be able to lower this price and make a profit. For example, suppose he is a printer making a book. The cost of setting up the type of a book is heavy, and if only ten copies of the book were printed, each of the ten copies would have to bear in its price a tenth of the cost of the typesetting. Suppose the cost of setting were $500, then each of the ten books for typesetting alone would cost $50, and probably no one would be willing to buy the book at $50 in addition to the cost of paper and binding and the printer's profit. But suppose ten thousand copies of the book were printed, then the typesetting would amount to only a few cents instead of $50, for each book. The book could then be sold at a low price and yet yield a profit. A newspaper, which only rich men could afford to buy if only a few copies were printed, can be sold for a low price because so many people buy it.

It is, of course, very difficult in actual business for anybody to decide at what price a certain supply can be sold. In practice business men judge by experience. It sometimes takes great courage and enterprise to induce a man to make a large quantity of a certain kind of article, in the hope that the price at which he can offer it can be met by the demand of persons willing and able to buy at that price.

Price stands between demand and supply, and is affected by them in opposite ways. Rising prices lead to a greater supply and a smaller demand. Falling prices, on the other hand, lead to a smaller supply and a greater demand. It is equally true that a bigger supply or a smaller demand leads to lower prices, and that a smaller supply or a bigger demand leads to higher prices.

HOW THE LAWS OF SUPPLY AND DEMAND CONTROL THE PRICE OF THINGS

In any market, whether it is in tea, or in sugar, or in steel, or in shares of companies, price is arrived at at any moment by the action and reaction of supply and demand. If there are more buyers than sellers, up goes the price. If there are more sellers than buyers, down goes the price. These rises and falls of price, we see, do not depend on the value in use of the article. Tea of the same quality is just as good to drink whether it is cheap or whether it is expensive; its price on the market depends on the relation of supply to demand. No matter how valuable a thing in use may be, if a large quantity of it comes on the market at one time its price will fall. It is none the worse because it is cheaper.

For example, suppose someone discovered how to make artificial diamonds as large as natural ones at a low cost, and were to make thousands of them and to bring them all to market. He would not be able to sell them at the present high price of diamonds, which depends on their scarcity. If he wanted to sell them all, he would have to bring down his price, and the price of the natural diamonds, though these were as beautiful and as valuable in use as ever, would fall also.

MASS PRODUCTION, WHICH HAS BROUGHT WATCHES WITHIN THE REACH OF ALL

Time was when very few watches were made, and then only at a very great cost. The supply was very small, at a price which few could pay. The equality of supply and demand was reached, therefore, at a very high level, and only rich men could possess watches. Nowadays very good watches are made in great factories where each tiny part is turned out by the thousand, so that when the parts are put together the factory-made watch can be offered profitably to the public at a very low figure. The supply is great, and at that low supply price the demand is great, and so it comes about that even poor people can now possess watches.

Here are the laws of supply and demand in a nutshell: *When supply is greater than demand, the price falls; when supply is smaller, the price rises.*

Even a small shortage of supply or a small increase in demand often causes a considerable difference in price. When supplies run very short, the rise in prices may be very serious indeed, enabling those who have stocks to make very great profits and cause serious inconvenience and suffering to many people.

WHY THE GOVERNMENT CONTROLLED PRICES DURING THE WORLD WAR

In the World War, for instance, the supplies of certain articles became very short. As a result the prices became very high. The Government then decided that in such unusual circumstances it could not allow ordinary trading to continue. It therefore interfered with the laws of supply and demand, and controlled the prices on behalf of the public. In Europe the governments had to do the same thing with many articles, including metals, fibres, and important foods such as wheat and other cereals, beans and peas, meat, coffee and cocoa, cheese, apples, potatoes, sugar and fish.

The amount of labor put into a thing does not necessarily determine its value in exchange. It does not even determine its value in use. For example, a man might spend his time digging a hole in the ground where no one wanted a hole. Suppose he spent a week on the task and pleaded at the end of it that, as he had worked laboriously for forty-eight hours in digging the hole, it ought to be worth something. We could only reply that it was a great pity he had wasted his time.

THERE MUST BE CHEAP PRODUCTION IF THERE ARE TO BE BIG SALES

Even if we make an article which has some value in exchange, we must not expect the price it will bring to be in any way dependent on the trouble or time we have spent in producing it. Somebody else may have discovered how to produce ten such articles while we produce one, and, if so, we must expect the price to be governed, not by our one article which took us so long to make, but by the offer of ten articles which were made with more skill and less labor. That is why it is so important to learn how to make things well and quickly. Those who come to market with things on which unnecessary labor has been spent will only lose money, and find it necessary to give up business unless they can learn how to produce their goods more cheaply.

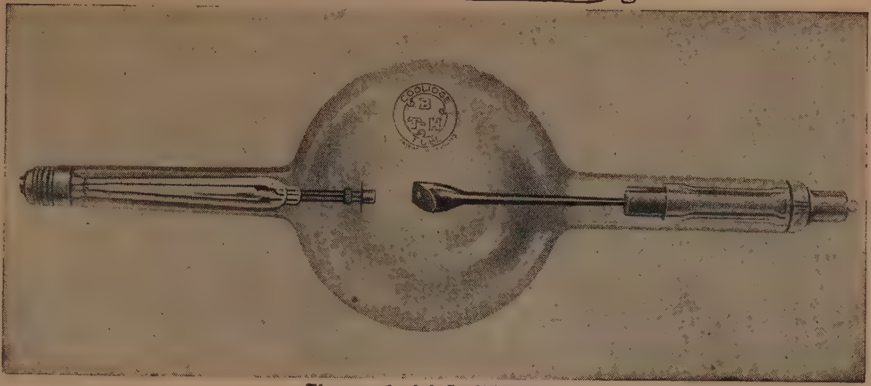
Imagine that there are two coal-mines, and that from one of them coal can be got easily, while from the other, because the seams of coal are thin, it is more costly to get the mineral. No one will offer a higher price for the coal from the poor coal-mine; the coal will only bring the same price for the same quality on the same day, whether it came out of a good mine or a bad mine, or whether it cost much or little to get. That is why some coal-mines close down.

It is also very interesting to notice that the demand at any price, however low, for an article, is limited by human needs, and that therefore there is a point for every article at which demand will cease. For example, our capacity to eat bread is limited by our physiological needs. If, therefore, ten times as much wheat came to market as the nation needed, it would not be bought, no matter how cheap it was offered.

THE CENTRAL MARKET, WHICH KEEPS THE PRICE OF GRAIN STEADY

In our modern civilized communities there are recognized markets in which different goods are dealt in. In ordinary times these big recognized markets help to keep prices steady, though the men who produce the article do not always think so. We can easily understand this. If there were little markets in every village where grain is raised, the price of grain in each town would always be going wildly up and down, because sometimes there would be more grain than buyers, and sometimes more buyers than grain. Also the price of grain on any day would be quite different in two towns. When, however, there is one big wholesale grain market, the supply and demand of the entire country become expressed and focused, as light is focused by a magnifying glass, in one place, and so the wholesale price of grain becomes much steadier than it would be otherwise.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 6091.



The wonderful Coolidge tube.

ELECTRIC LIGHT AND HEAT

THE story of electric light is one of the most interesting chapters of invention. Men knew a great deal about the power and the transformations of electricity before they could turn it into useful light. The electric lamp came a long time after the steam engine, and even to-day it has not entirely replaced its sister light—incandescent gas.

The electric lamp must be looked upon as a tiny machine which turns electricity into light. The lamps of to-day give just eight times as much brightness for a given amount of electricity as the early lamps of 1880. They are wonderfully efficient. But they have not reached the limit of perfection.

The electric arc, the first real type of electric lamp, is the only artificial light which in any way compares in grandeur with that king of lights, the sun. It was discovered by an Englishman, Sir Humphry Davy, in the early part of the nineteenth century, and although for general convenience it has been largely replaced by the little glass bulbs so familiar in our own homes, it is still used wherever very powerful light is required, and so intense is the heat of its flame that huge electric arcs are used in industry to make what are known as electric furnaces.

Sir Humphry Davy began by discovering the most powerful light the world had known; he later invented perhaps the feeblest—the miner's safety-lamp, which has saved many thousands of lives. He invented the arc-lamp through finding that if two pieces of carbon are joined to the poles of a powerful battery, and are brought together, intense heat is produced which turns some of the solid carbon into gas. This gas acts as a conductor of electricity, and if the pieces of carbon are drawn slightly apart the current will continue to flow across this gaseous path, emitting an enormously powerful light, due to the burning particles of carbon.

With a huge battery of 2,000 cells Davy produced an arc-flame four inches long. It later became known that such a high voltage as this battery gave is not wise; a low voltage is sufficient to produce an arc, and the amount of light given is made to depend on the current that is supplied to it.

THE BRILLIANT ARC-LAMP THAT SHINES IN THE STREETS AT NIGHT

The arc-lamp led to a new need for engineering skill. Carbon rods were used to strike the arc, but as they must be not more than a fixed distance apart, some means had to be devised to adjust them. As the rods burned away they had to be continually brought nearer together. Ingenious magnetic mechanism was designed to do this, and so the *automatic feed* became a general thing. The large glass bulbs we see suspended from the tall steel posts in the streets are lowered every morning to the ground, and a man fits in a fresh supply of carbon rods. The lamps are then drawn up again to the top of the standards.

The light of the electric arc is very blue, but if a hole running through the length of the rods is packed with certain chemicals the color of the arc-flame can be changed to a gold tint. If the carbon rods are inclosed in an airtight glass vessel, the flame soon burns up all the oxygen in the air inside, and, as air is a mixture of the two gases oxygen and nitrogen, the nitrogen is left behind; the arc-flame then becomes intensely violet in color, and such an arc is much used in photographic work.

THE AMERICAN ENGINEER THAT INVENTED THE CARBON LAMP

The electric lamps in our homes are very different from the arc-lamps, and have a history all their own. They date back to 1841, when an American engineer named Starr invented a lamp which produced light by sending an electric current through a very fine piece of carbon, which became so hot that it grew incandescent. We know that all materials offer more or less resistance to the passage of an electric current. The thinner or smaller the material, the greater is the resistance offered; and in the second half of the nineteenth century two master minds—those of Edison and Swan—were engaged, unknown to each other, at the same time, in producing a fine wire of carbon which would glow brilliantly with the heat produced in it when an electric current passed through it. These very fine carbon wires were known as filaments, and Edison first made his of little strips of burned, or *carbonized,* bamboo, while Swan used a thread of cotton chemically treated.

Lamps made in this way, known as carbon-filament lamps, held the field for more than twenty years, from 1880 until 1904. The threads of cotton or shreds of bamboo were placed in a small glass bulb, and, turned into a charred wire, they became so strongly heated when a current passed through the lamp that they glowed with a brilliant white light. So successful were they that they were used on a large scale, and the era of the electric light began in earnest.

THE LAMP THAT ASTONISHED THE WORLD BY ITS BRIGHTNESS

The price of electricity was such that it was rather a luxury to have a house fitted with electric light, but the wonderful convenience of being able to flood a room with light by touching a switch was fascinating. Matches, gas, the smell of oil lamps became things of the past, and a new impetus was given to electricity. The electric car and train had hardly been thought of, the value of the electric furnace was undiscovered, electric stoves and heating appliances were unguessed; the carbon-filament lamps made the first real demand for big quantities of electricity, and paved the way for its use in the thousand-and-one forms in which we know it to-day.

Wonderful possibilities were opened up in 1907 by the German scientist Nernst, who invented a new lamp of astonishing brilliancy. It was too complicated for most people, but it led the way to the splendid lamps we have to-day, which give a beautiful white light at an eighth of the cost of the early carbon-filament lamps. The Nernst electric light was like an incandescent gas-mantle concentrated into a tiny stick which conveyed the current, raising it to a white heat such as had never before been equaled.

THE METAL THAT WILL STAND GREAT HEATS

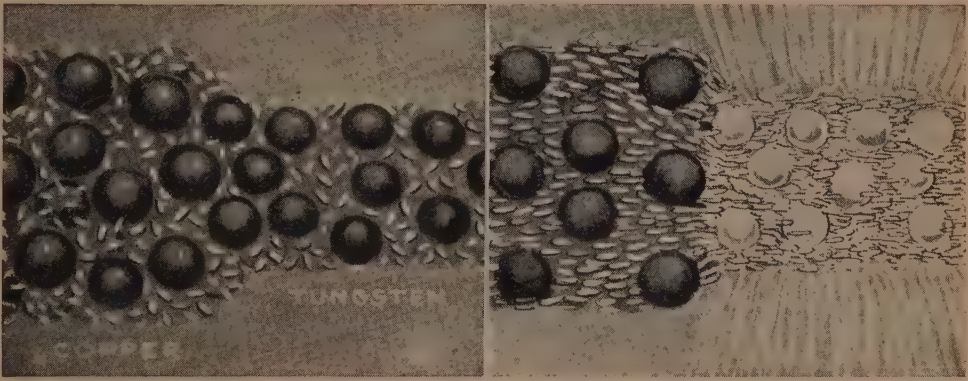
In the meantime the chemists had been busy, and it had been found that a metal called tungsten would withstand enormous heat, and glow with a very brilliant white light. In 1906 a drawn wire of tungsten was made by the General Electric Company in their experimental laboratories in Schenectady; and when sealed into the little glass bulb, with an electric current passing through, the wire not only gave a purer white light than any other known, but gave much more light for a given amount of electricity.

This important discovery revolutionized not only electric lighting, but the whole of electricity, for lighting now became so cheap that electricity was before long in great demand.

The success and importance of the tungsten lamp was that it gave four times the light of the old carbon-filament lamps for the same number of units of electricity. This meant that electric lighting would in future cost only a quarter of what it had cost before, and with this discovery electricity became the cheapest substitute for sunshine, instead of the dearest. Osmium, tantalum and tungsten are rare metals used in the modern electric lights.

The making of one of the little bulbs that light a house is a scientific operation requiring great skill, and fortunes have been spent in working out a hundred problems met with in their manufacture. The tungsten filament, which glows white when the lamp is switched on, represents years of tireless experiment.

First of all a crude ore dug from the mines, called wolframite, is crushed in the mills. It is then mixed with soda-ash and roasted in a furnace. Various chemical processes are employed, and a yellow powder called oxid of tungsten is produced. This yellow oxid is baked in another furnace at a temperature ten times hotter than boiling water, and afterward it is turned into tungsten metal, again in the form of a powder, by treatment with hydrogen gas.



THE SECRET OF THE ELECTRIC LAMP—WHY OUR STREETS ARE SO BRIGHTLY LIGHTED

These picture-diagrams show why we can light our streets with electricity. On the left we see the tiny electrons and big molecules of the thick copper wire and the thin tungsten filament within the lamp before the electric current flows. The switching on of the current sends through the wires myriads of new electrons which collide with the molecules so forcibly that heat is produced. Owing to its extreme thinness, the filament gives less space for the electrons to move in, and the greater resistance to their passage produces a fierce heat causing the filament to glow as in the right-hand picture.

The powder is weighed out into little lots, and pressed into "slugs" by a hydraulic press. The slugs, each one the size of a fountain-pen, are raised to an intense heat and beaten with rapidly moving hammers. This operation is called "swaging," and the effect is to beat out the tiny crystals of tungsten into long ones, which makes the material much more pliable.

THE LITTLE BULB ON WHICH FORTUNES HAVE BEEN SPENT

The heated slugs are forced through a diamond in which a tiny hole has been drilled and the metal is literally squirted out into one long filament. A length of this black filament is sealed into the glass bulb, and now comes the final and important operation of getting rid of the air in the bulb.

Every electric bulb is a little vacuum chamber, containing only one ten-millionth part of the amount of air that it could hold. The really high vacuum achieved in the modern lamp is obtained with the help of a little bit of phosphorus, which "cleans up" the tiny traces of gas that cling to the inside of the bulb and to the various parts.

We thus see that the friendly little lamps that are such constant companions when the sun has gone down are by no means as simple as they look. They represent the work of many people and the operations of several factories, beginning right back at the mines where the tungsten ores are found.

In quite recent years another great advance has been made in the electric light—the introduction of a very small quantity of certain gases into the bulbs, the result of which is a lamp giving twice as bright a light as before. The gases used for these lamps are argon and nitrogen; they are known as *inert* gases—lazy, unfriendly elements which will combine with *nothing*, and cannot, therefore, do any harm.

Such lamps are used on an enormous scale to-day. They have made light so cheap that it is used to excess, and a busy street of large shops is almost bewildering in its brilliance. Many a home is too brightly lighted, and what the effect on the eyesight will be a generation hence remains to be seen.

HOW THE SEA IS SWEPT WITH THE LIGHT OF A MILLION CANDLES

The photographer, too, has turned night into day, and electric lamps illuminate his studio so brightly that he can take portraits in a far shorter time than he can do even in the full light of day.

Whenever we want to produce light of enormous power we have to turn to the electric arc. The light of a million candles can be concentrated in that blinding little flame which plays between the carbon rods. Special reflectors placed behind the light send the powerful rays through the darkness in the form of a narrow beam which carries for miles. This is the searchlight of the giant battleship, which can sweep the sea around it with a beam of light in which nothing can be concealed. Its field is as bright as day.

THE WONDERFUL RAYS WHICH HAVE TAUGHT US SO MUCH

Many strange and beautiful things happen when a current of electricity is passed through a gas such as air or nitrogen. Most gases offer great resistance to electricity in the ordinary state, but if inclosed in glass tubes—in which there is a partial vacuum—the current will pass through the tubes and cause the gases to glow with all kinds of exquisite colors.

The vacuum tube with which these colors are produced is the first link in the chain of circumstances which led to the romantic discovery of what are called the Röntgen rays, or the X-rays.

If the tube containing the gas is exhausted to about a millionth of an atmosphere—which means that only a millionth part of the gas that would like to stay in the tube is allowed to do so—the current, on passing through it, causes a lovely apple-green color to appear on the glass. This phosphorescence is caused by the rays from the negative pole of the vacuum tube—the rays called cathode rays, which are the key to one of the most wonderful secrets in the world. A great deal was discovered about them by the late Sir William Crookes, after whom the famous Crookes tube was named.

THE ACCIDENTAL DISCOVERY OF THE MARVELOUS X-RAYS

In 1895 Röntgen was in his laboratory making some experiments with a Crookes tube which he had wrapped up in black paper so that no light could be seen from it. To his intense astonishment he noticed that a piece of cardboard covered with some yellow crystals, which was lying on a table some yards away, was glowing brightly! He could only conclude that some rays from the Crookes tube must have penetrated the black paper, traveled to the crystals and caused them to become phosphorescent. The X-rays had been discovered.

The cardboard screen was coated with crystals of barium platino-cyanid, and in spite of all the progress made in the X-ray world since 1895 this substance still remains the most remarkable substance known for the brilliance of the light it gives when excited by X-rays.

Having discovered that the new rays penetrated black paper, it did not take Professor Röntgen long to show that they would penetrate flesh. The cardboard screen coated with the crystals was found, when held behind the hand, to reveal the bones through the flesh, which appeared transparent.

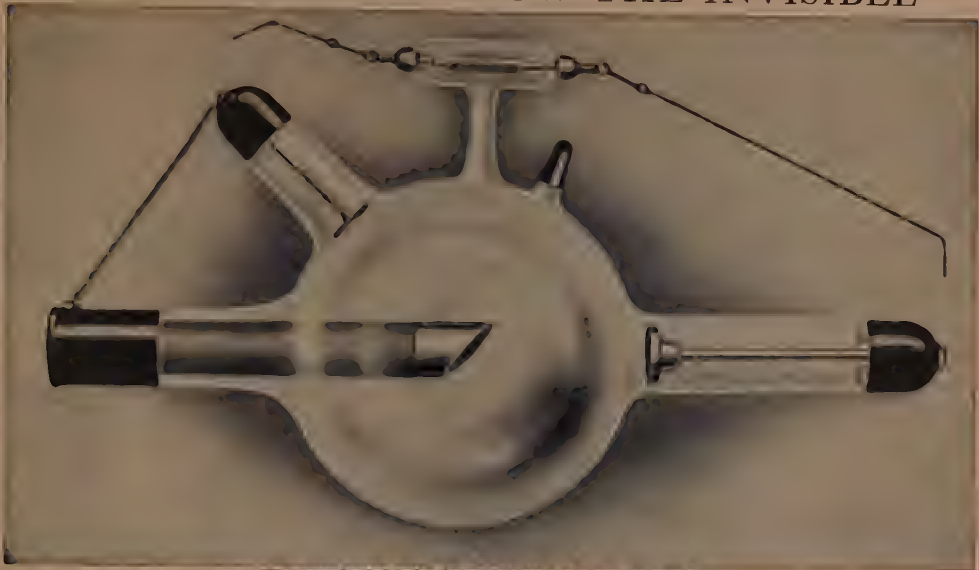
The value of this marvelous discovery was immediately recognized. The news was telegraphed to all parts of the world, with the further news that the rays which would pass through the flesh would also make an impression on a photographic plate. Within a day or two scientific men had taken some of the first photographs of the bones in the human body with remarkable success.

THE WONDERFUL LEAP IN SURGERY MADE POSSIBLE BY THE X-RAYS

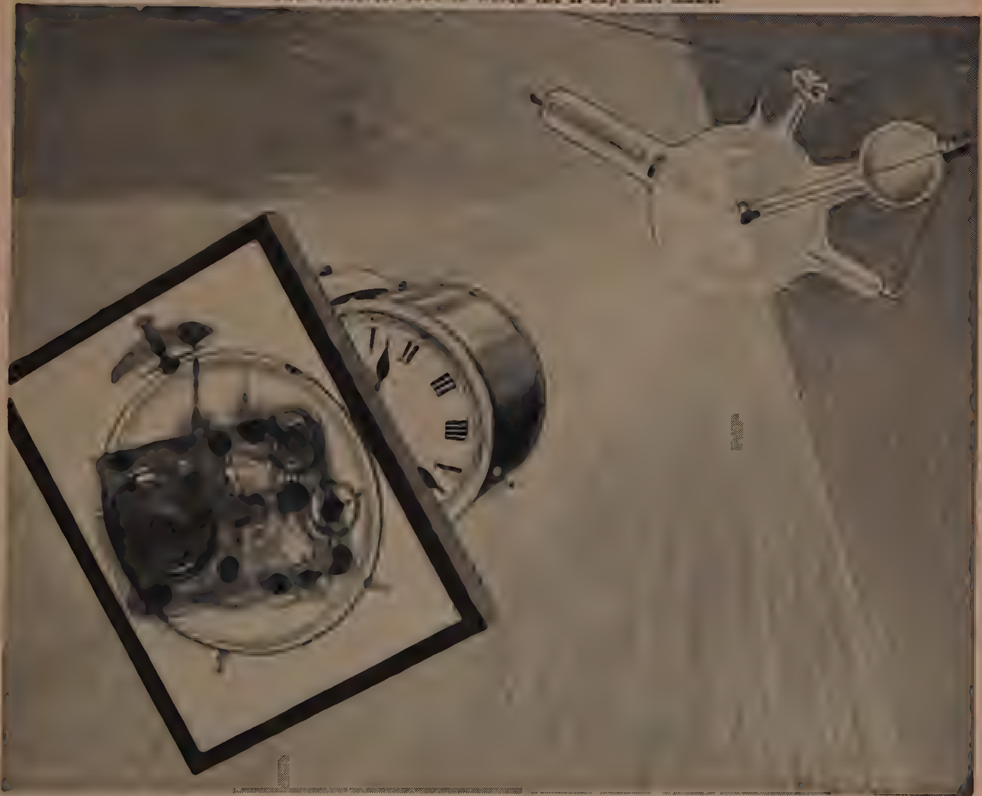
The discovery of the X-rays had opened up a new branch of science, which advanced with incredible speed and soon became of the utmost importance to mankind. It was very soon realized that it would henceforth be possible to detect a swallowed coin, or a pin or needle buried in the flesh, and to see exactly how a bone was broken, by passing a beam of these new rays through the body.

To-day every hospital is equipped with an X-ray outfit. Many dentists use the rays in their work with great success. Men going down into mines are examined with them, so that their lungs may be tested and their health preserved.

THE RAYS THAT SHOW THE INVISIBLE



The wonderful tube in which the X-rays are made.



Here our scientific artist has tried to indicate how the X-rays show us the inside of a thing. The electric current is passed into a mysterious glass bulb, and the electrons try to leap across the space between the two poles of the tube. In the centre of the tube, however, is a device for stopping them, and this has the effect of throwing them back and changing their character so that the rays they give off pass through the glass and are thrown on to the object to be photographed Here we see the rays thrown on to a small clock. The rays pass through the glass, the dial and the printed figures, but are resisted by denser substances, so that the more solid parts are thrown in shadow on a screen or on a photographic plate.

The powerful X-rays which have been produced within the last few years will mean a new era of machine construction, when accidents due to faulty castings used in machinery will be things of the past. There will be an X-ray doctor in an engineering works who will examine a machine or a piece of metal with the rays as doctors examine the human body. Machines which might cause great damage and loss of life by breaking down, or coming apart while running at a great speed, will be made to stand the searching test of the X-rays.

THE BULB WHICH TAKES A CURRENT OF A HUNDRED THOUSAND VOLTS

Let us see how an X-ray photograph is taken. The rays themselves are produced by passing the current from a large induction coil through a glass bulb from which all but about one-millionth part of the air has been withdrawn. In many cases the vacuum is even higher than this. The two plain conductors at each end of the Crookes tube are replaced by heavier ones, and between them is fixed a device known as an *anti-cathode,* for stopping the terrific stream of cathode rays which is trying to jump across the tube. This anti-cathode turns the rays about at right angles, so that they are thrown outward from the tube. The fierce bombardment of the anti-cathode, usually a button made of tungsten which resists the intense heat produced in it, gives rise to a stream of X-rays, which is thrown out from the bulb.

The resistance of a bulb containing so little air is enormous, as voltaic electricity cannot travel across a vacuum. The result is that an X-ray tube has to be supplied with current at a very high voltage, usually 100,000 or more. This current, given off by the secondary wire of very big induction coils, may blaze across perhaps twenty inches of air if allowed to jump the ends of the coil instead of passing through the tube. This electric spark is sometimes so fierce that it takes the form of an exquisite sheet of flame as delicate in texture as a spider's web, and occurring in beautiful folds like the dress of a dancer.

THE DULL GREEN GLOW THAT HIDES A GREAT POWER

When the current is passed through the X-ray tube nothing is seen but a dull green glow on the glass bulb, caused by phosphorescence. The X-rays themselves are invisible, and their presence can be detected only by means of phosphorescent crystals, by the effect they produce on a photographic plate, or by their power of making air a conducting medium.

The complete equipment for a hospital or consulting-room is often mounted up in a neat cabinet, which can be wheeled about a ward or sick-room and brought to a bedside. It is not very formidable-looking. The induction coil is mounted on a box, and wires from the two terminals are fastened to the ends of the tube, which rests in a wooden box fixed to an arm so that it can be swung out into any desired position. One of the wires is cut in the middle and joined to what is termed a *valve.* This valve, like those used in wireless, allows the current to pass only in one direction, as it is very important for an X-ray tube that no "reverse" currents should traverse it.

The greatest care must be taken when using the rays, as they can produce very bad effects upon the skin and the flesh, even destroying it completely in time. Some of the famous early workers, knowing nothing of the dangers lurking behind the new power, used the rays too freely, and several of them have since lost their lives. Every precaution is now taken to shield the operator. Lead is the best protective substance, as it is one of the heaviest metals, and therefore difficult for the rays to penetrate. A mixture of lead and rubber has been invented, of which gloves, aprons and face-masks are manufactured. Glass, too, is made containing two-fifths of its weight of lead, and this is used for protective screens.

THE X-RAY EYE THAT CAN LOOK THROUGH BUILDINGS

The X-ray tube itself is frequently inclosed in a box heavily lined with lead, as much as a quarter of a ton of it being sometimes used. The beam of rays passes through a small hole in the front of the box, and everywhere else the rays are screened off. It has actually been found possible to take an X-ray photograph with rays that have traveled a hundred yards from a hospital into another building!

Extra powerful, or "hard," rays, as they are called, have the power of attacking abnormal growths before they attack the healthy tissues of the body, and they are being used increasingly for the treatment of patients, effecting many cures without the aid of surgery.

One interesting commercial use to which X-rays are put is to destroy a microbe which attacks the leaves of the tobacco plant. Great losses have been hitherto incurred through the destruction of valuable tobacco leaf, but infected tobacco can now be carried on a slowly moving band which passes under powerful X-ray tubes, and under the influence of the mysterious rays the troublesome microbes are destroyed.

Many other X-ray appliances which have nothing to do with medicine are in use. Custom-house officers sometimes examine bales and packages to find whether objects liable to duty have been concealed in them. Shoemakers have also used a neat X-ray box over which the foot can be placed when trying on a pair of shoes. The bones of the foot can be seen inside the shoe, and if the foot is cramped or uncomfortable the fault can be remedied.

Rare stones can, in many cases, be distinguished from imitations when examined with the X-rays. The diamond will appear nearly transparent, while imitation stones look almost black.

An X-ray photograph of a frog.

THE LIGHT THAT SHOWS A HUMAN HEART BEATING

Truly the progress made in X-ray work since Professor Röntgen's discovery is little short of marvelous. The speed with which a photograph can be taken has been reduced from several minutes to a thousandth of a second. Moving-picture X-ray pictures have been taken showing the heart beating, the human lungs at work, and similar physiological wonders. The power they have given a doctor to see inside his patient has proved one of the greatest blessings that science has ever rendered to mankind.

An invention made a few years ago by Dr. Coolidge has completely changed the future outlook for X-rays. He discovered a simple way in which the rays may be given power to penetrate even the heaviest metals. Look at an ordinary electric lamp when it is lighted. Try to imagine millions of tiny electrons flying away from the incandescent filament. Dr. Coolidge placed a spiral incandescent filament in the negative pole of his tube, so that it shot out a stream of these electrons toward the positive pole. The electrons provide an easy path along which the cathode rays can travel. The more electrons there are, the easier it is for the cathode rays to bridge the distance between negative and positive, so that as the filament is heated to greater and greater incandescence, more and more cathode rays bombard the anticathode, and more and more powerful X-rays are generated.

But if only a small stream of electrons is passed, the cathode rays will find the utmost difficulty in crossing the space between the negative and positive poles of the X-ray tube. The only way in which they can be made to do it is by increasing the voltage—the driving power—of the current used to excite the tube. Now, the penetrating power of the rays depends entirely on the volts, so that by adjusting his tube Dr. Coolidge was able to produce rays of a penetrating power never before imagined.

HOW A CLEVER DOCTOR MADE THE X-RAYS GO THROUGH STEEL

This wonderful device of Dr. Coolidge opened up a new era in the history of X-rays. A strong enough blow has only to be given to a stake in the ground to drive it in still deeper, and in the same way a beam of X-rays has only to be made penetrating enough for it to probe the hardest metal. The Coolidge tube gave X-rays a new driving force which enabled them to penetrate three or four inches of steel. They pass through the human body as if it were air; it requires the heavy casting of an engine-shaft of a thick armor-plate to curb their intensity. Yet so marvelously can they be controlled that they can be made soft enough to photograph the delicate structure of the petal of a cherry blossom or a butterfly's wing.

Let us see what these rays mean to engineers. When some part of an engine is made it is first made as a casting, molten metal being poured into a mold of the necessary shape, and the cold casting then goes through elaborate processes of machining until it ends up as a beautiful piece of workmanship. But there may be a flaw in the casting, a fault that may possibly cause the machinery to fly to pieces when running.

THE MARVEL WHICH GIVES US A PEEP INSIDE A LUMP OF IRON

It was quite impossible to detect such flaws until the X-rays were used, until a man could *see inside a piece of metal.* Now a man can take a photograph of the casting which will reveal the smallest flaw, and by doing this when the casting is in its crude state, all the useless labor and time that would have been spent in machining and perfecting a faulty piece of metal may be saved.

Important parts of the woodwork of airplanes, on which the lives of the pilot and the passengers may depend, are now examined with the rays. Holes made in wood by invisible worms are easily revealed. The ravages of these insects may be such as to ruin the power of some vital part to withstand the strain on it during flight, and they have been responsible for many disastrous accidents. The X-rays, by enabling the destructive work of these creatures to be seen, have added a new safety to flight.

The most wonderful of all the marvels revealed by the rays is one which we can refer to only very briefly. They have shown that nearly all the substances we know and use in everyday life are composed of crystals, each crystal being a mass of atoms regularly spaced with a beautiful symmetry. Sir William Bragg and his son have shown how these atoms are spaced in what are called the crystal lattices of different substances. A new world has been discovered, telling us things about the way in which Nature goes to work in piecing together the elements.

ELECTRIC FURNACE PRODUCES THE MOST INTENSE HEAT

The most intense heat that man can produce is that of the electric furnace. There are to-day more than a thousand electric furnaces in the world making steel. They produce more than four million tons of steel from the crude iron every year. The enormous heat which electricity will give has been applied to a number of industries, and to such interesting problems as the making of artificial diamonds.

Thus from the arc-lamp of Sir Humphry Davy, used for so many years as a source of light, there has come the huge electric furnace of industry—a lamp of millions on millions of candle power, in the flame of which the bonds which unite Nature's simple elements break down as if smitten by a fairy spell.

If we dip a finger into very hot water we are conscious of a sharp pain, and get some idea of what heat means. We know more or less what the heat of boiling water feels like—a temperature of 100° on the Centigrade scale. But it is very difficult to understand even dimly the extraordinary heat of the electric furnace, which can be as much as 4,000 degrees.

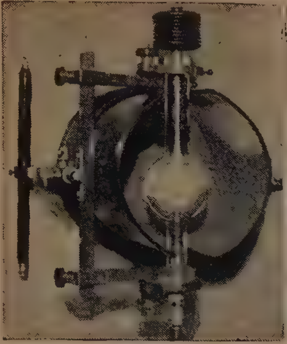
THE ELECTRIC ARC THAT MELTS ALMOST ANYTHING

The temperature of the hottest part of a gas flame, as used to light an incandescent gas-mantle, is about 1,500 degrees. The electric arc is nearly three times as hot. With its heat the chemist has been able to melt substances never melted before, and to produce many remarkable chemical effects.

Just as the alchemist of old attempted to use chemical science for turning base or cheap metals into gold, so for many years the new power offered by the electric furnace tempted a new kind of alchemist to try his skill at making diamonds. Certainly the new alchemist has had better results, for he has succeeded in making diamonds as genuine and as real as those dug from the mines. But they were too small, and despite all efforts the artificial diamond has never been made of larger size than a mere speck of matter.

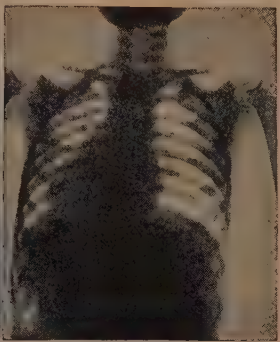
Diamonds are nothing more than crystals of carbon. If a chemist wants to make crystals of any substance he dis-

THE X-RAYS AND THE POWER BEHIND THEM

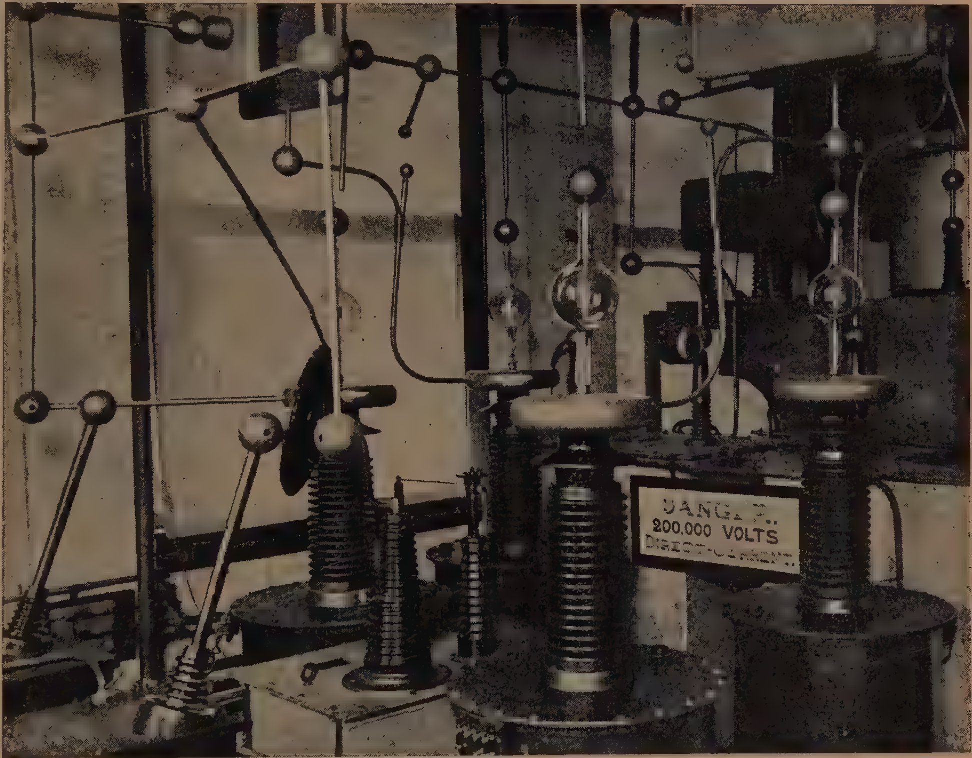


A powerful new X-ray tube.

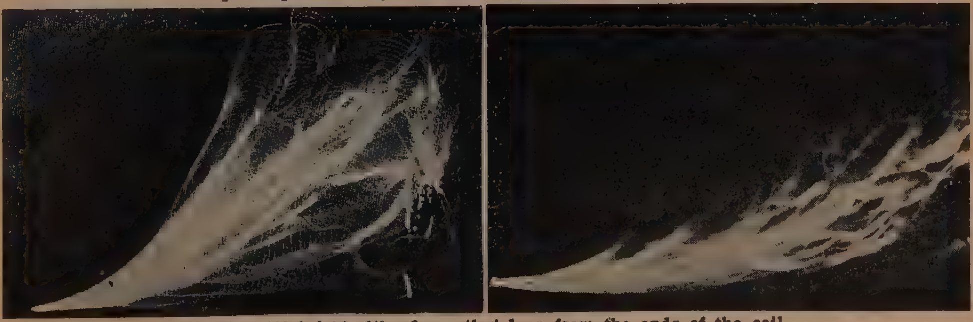
Photographing through a brick wall.



A coin swallowed by a child.


200,000 VOLTS
DIRECT-CURRENT.

The power plant of a great X-ray machine at Columbia University.



The beautiful folds like flame that leap from the ends of the coil.

solves that substance in water or some other liquid and lets the solution evaporate. As the water evaporates little crystals of the substance begin to appear on the side of the vessel.

The artificial diamond is made in almost the same way. The French chemist Moissan knew that carbon would dissolve in molten iron, and that if the molten iron was made very hot—as by an electric furnace—the quantity of carbon that will dissolve in the iron becomes much greater.

When the molten iron containing the carbon had reached a temperature of 4,000° Moissan plunged his crucible into cold water, and the sudden cooling at once formed a solid outer layer of iron, within which the yet molten iron eventually became solid, too.

HOW MEN TRIED TO COAX THE CARBON TO BECOME A DIAMOND

On becoming solid the molten iron would expand in the ordinary way. Let us imagine the molten mass imprisoned within the outer wall of iron and we can understand how enormous pressure was produced—pressure which caused the crystals of carbon—tiny diamonds—to be formed, just as crystals of salt are given up on drying a solution of salt and water.

Moissan took the solid lump of metal from his crucible, dissolved away the iron, and found as many as fifteen diamonds in a single ingot. The rarest gem in nature had been made in the laboratory!

How, from that time on, men fought with the black, worthless carbon and tried to coax it to grow into its beautiful sister substance, the diamond, we can well understand. But the artificial gem remains obdurate. It defies all attempts to make it in any other form than useless little specks.

The electric furnace eats up very big quantities of electricity, but its simplicity and ease of working place it far above the ordinary furnace for many purposes. The production of steel from cold pig-iron or iron scrap requires about a thousand kilowatt hours for each ton. That means the use of a million watts for one hour, for a kilowatt is a thousand watts.

Huge quantities of current such as this do not matter very much in a district where there is plenty of water power, as a dynamo need only be big enough in order to convert enough power into electricity for any purpose.

In these terrific furnaces, crammed with coal and iron-ore, a fire of thousands of degrees bursts forth, generating heat such as we can hardly think of, which splits up the elements which have lain solid in the earth for millions of years. Back goes the oxygen, in the form of carbonic oxid, to feed the forests and the fields; away runs the iron in a red-hot stream to build ships and engines and machines for the busy workaday world.

The huge furnaces used may turn out as much as 180 tons of high-grade steel a day, and steel is only one of the things the electric furnace is used for. Another great industry is the making of calcium carbide, a gray substance which, when moistened with water, gives off acetylene gas. This gas, on account of its intense heat, and mixed with oxygen, is used on a big scale for acetylene welding.

Although this important substance had been made by a German chemist named Wöhler as long ago as 1862, it was not until the day of the electric furnace that it could be made on a useful scale, and Moissan and an American named Wilson made the discovery almost simultaneously in 1892. Lime and carbon are mixed together and are heated in the furnace, when calcium carbide is produced, together with monoxid of carbon, a gas which easily escapes.

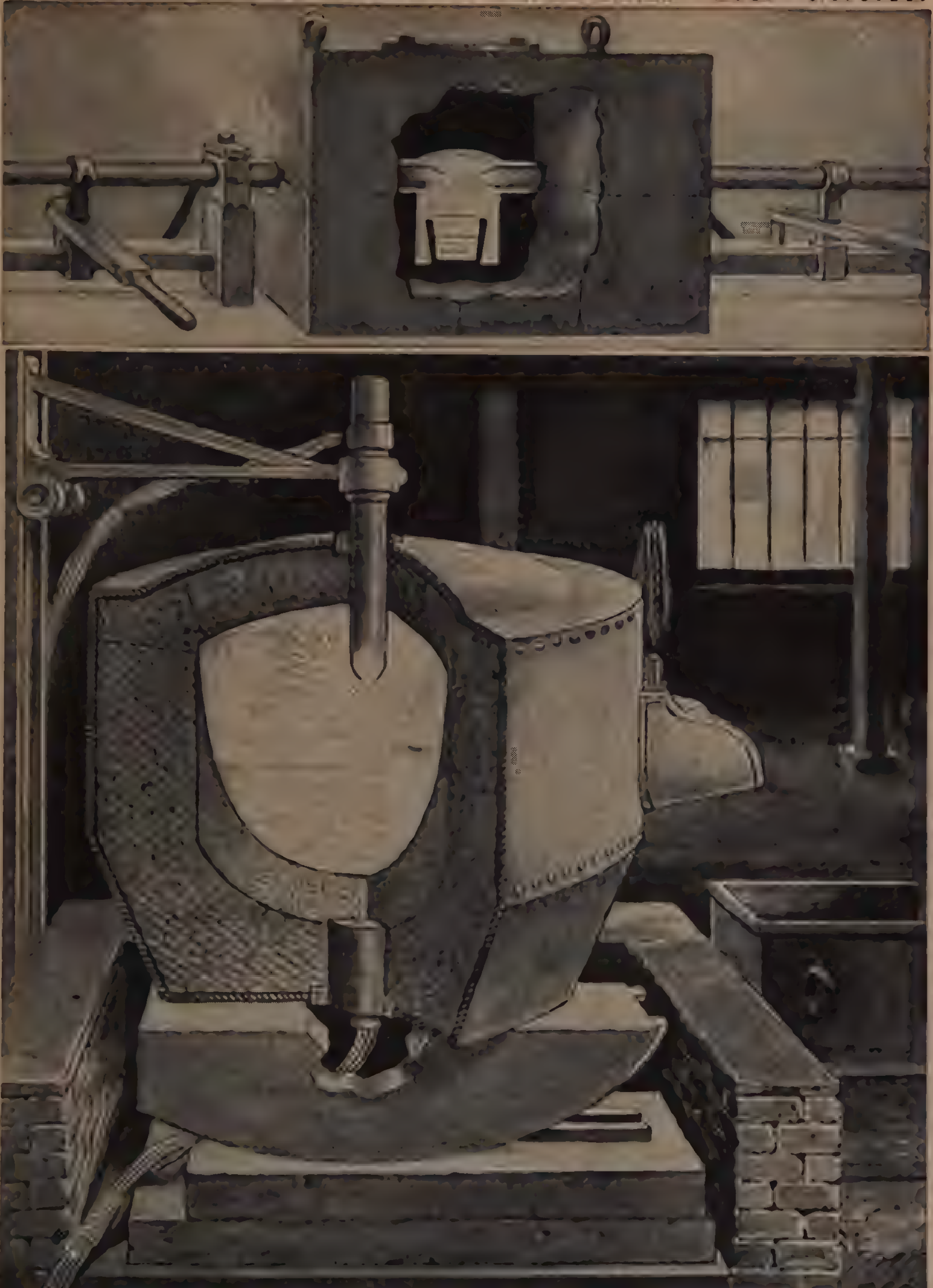
THE PROCESS THAT WILL BRING THE FUTURE UNTOLD WEALTH

Calcium carbide is tremendously important because it is a sort of halfway substance used in the preparation of cyanamid, from which the farmer obtains large quantities of fertilizer. Thousands of tons of calcium carbide are made every year for this purpose at Niagara Falls and at Odde, Norway. Power is harnessed from near-by waterfalls to produce the necessary electricity.

We next come to a process which depends on the electric furnace, and which will mean untold wealth to future generations—the process of obtaining large supplies of nitrogen from the air.

Every living plant—every ear of corn, every blade of grass and every green vegetable used for feeding cattle—requires nitrogen. The world to-day wants more nitrogen than it has got. The world of to-morrow will want millions of tons more. Without the electric furnace we should before long become faced with starvation. The interesting discovery of Sir Humphry

THE GREATEST HEAT THAT MEN CAN MAKE



In the electric furnace man has discovered a means of generating the greatest heat known on earth. In the Moissan arc furnace a temperature of nearly 4,000 degrees Centigrade is obtained—a temperature, that is to say, more than half that of the surface of the sun. Electric furnaces are constructed on two principles, which we see in the Moissan and Héroult types, shown here. In the Moissan type, in the top picture, the substance to be melted is placed in a chamber lined with some stubborn material and is exposed to the heat generated by the electric arc. In the Héroult type, shown below, the substance is placed under a carbon pole and is heated by the current that flashes across to it from the pole.

Davy has become an indispensable part of our civilization.

Nitrogen is obtained from the atmosphere chiefly in Norway at the present time, largely because the generous waterfalls in that mountainous country supply almost unlimited cheap power.

WHAT HAPPENS IN THE FIERCE HEAT OF AN ARC-FLAME

In the intense heat of an arc-flame the nitrogen and oxygen of the air do a thing they will never do in ordinary circumstances—they combine chemically to form a gas known as nitric oxid. The chemist can do with this gas what he cannot do with nitrogen alone. By allowing lime to absorb the gas he can turn it into nitrate of lime, and it is this substance which is made and sold for agricultural purposes.

An arc-flame is formed between powerful electrodes, and by means of an electric magnet the flame is repelled, so that a long sheet of flame of tremendous heat plays between the walls of the furnace. This blinding flame is called an *electric sun,* and it is probably the nearest thing to the actual sun that has been produced by man.

Through this flaming sun the air is driven, causing the formation of nitric oxid, which is passed through "towers" filled with milk of lime, where the so-called Norwegian saltpetre is manufactured.

The use of the electric furnace does not stop here. In a smaller form it is used for the purpose of welding. Boys and girls who drive an iron hoop know well how the hoop sometimes breaks at the join. It is taken to the blacksmith, who heats the broken ends of the hoop until they are red-hot, and then hammers them together, when a "weld" is made.

THE MAN WHO MUST SCREEN HIS EYES FROM THE FLAMES

The welding of large masses of iron and steel is a far more difficult matter, but it is accomplished with the help of the electric current. Here, again, the hot flame of the arc works hand in hand with the electromagnet.

The effect of a magnet on the flame is to throw it out, or deflect it. Two big carbon rods are mounted at right angles to each other, and by means of magnetic force the arc-flame between them is thrown upon the metal parts which are to be welded together. The weld can be built up to any desired thickness by feeding into the arc-flame a thin rod of metal, which melts and acts as a kind of glue, binding itself with the metal parts.

There is a terrific glare from such an intense welding flame, and the operator has to have both eyes and flesh protected by a dark-glass screen. The ultra-violet rays produced by the light would otherwise act harmfully upon him.

This method is used in building steel barrels and in welding the points of rails, and in many jobs that have to be done at a general engineering repair shop.

We read on page 5673 how an electric current makes metals hot. Certain metals offer great resistance to a current, and get very hot in consequence. This fact is made use of in certain kinds of welding. The current is passed through two bars of metal which are pressed together end to end; when the metal is hot enough the bars are "jumped" together, and become one piece. Twenty-two horse-power is needed for one minute to join two bars of iron an inch in diameter.

THE MANY USES OF THE SMALL ELECTRIC FURNACE

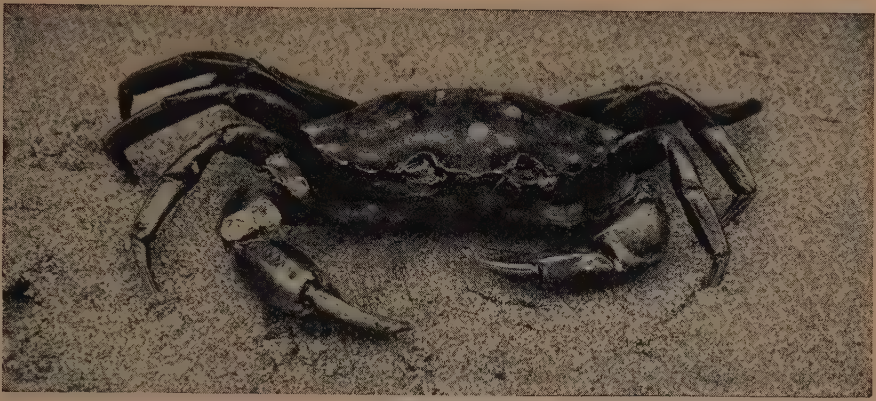
Electric welding has come to be used in late years for joining up the steel plates of which big ships are built, thus doing away with riveting.

Many small electric furnaces are used in industry, just large enough to take a small crucible, and heated by a red-hot resistance wire through which the current is passed. For hardening tools, too, small furnaces are used in many modern factories—little baths of salts fused or liquefied by the heat generated by the current into which the tools can be dipped. The little fifteen-ton electric furnace produces the finest alloy steels.

One of the most useful features of the electric arc furnace is that it will not only melt up a substance but will actually separate a pure metal from its native compound. Aluminium is made in this way. This silvery metal, so astonishingly light, is produced by fusing a mineral substance called bauxite by the heat of an arc-flame burning in a crucible. As the aluminium separates from the bauxite it makes its way to the bottom of the furnace and can be run off.

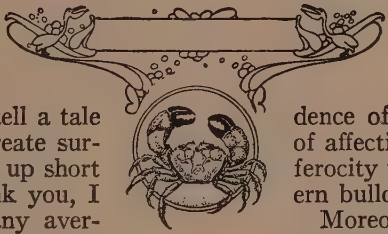
Electricity therefore not only melts the mother ore, but collects the metal from it in the highest state of purity at present known to chemists.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6049.



The Shore Crab.

CRABS, LOBSTERS AND THEIR KIN



AN unpleasant everyday experience is that which comes to us all when we begin to tell a tale which we hope will create surprise, and are brought up short by the remark, "Thank you, I have heard it." In any average company the story of the crabs, lobsters, and the strange little folk to which they are nearly allied in sea and on land, is proof against such disappointment. The facts are so strange that, were they not established truth, they would be received as the fictions of a jester.

How amusing it would sound, for example, if a comedian appeared on the stage with his hand bound up, declaring that he had been bitten by a crab while up a tree bird-nesting! And what a romancer we should think the man who assured us he had been gnawed and maimed by crabs when exploring a mountain height; or that his house had been damaged by myriads of crabs marching right through and over it!

Such things have happened. The old animal fables which our ancestors believed for centuries seem ludicrous to us now, but the facts about crabs and their kindred are almost as unbelievable as anything the old legends said. There are no backbones here, no spinal cords; but we find brain, highly organized nervous tissue, decided evidence of complicated instincts, of affection, of the courage and ferocity we impute to the modern bulldog.

Moreover, there is a history behind the group which inspires a touch of awe. Its members are so immensely ancient. We find their remains in the earliest rocks, and to-day the earth is full of them—more than ten thousand living species, differing widely in size, color, appearance and habits.

We call them Crustaceans, which means "having a crust," for most of them are covered with armor, an outside skeleton, so to speak. They inhabit both salt and fresh water, and some species spend most of their lives on land. The class includes crabs, lobsters, crayfish, shrimps, prawns, sand-hoppers, wood-lice and water-fleas, besides many tiny forms found in the seas and great lakes upon which fishes feed.

The body of a crustacean is made up of a number of segments, and to these segments are attached the legs, the parts which compose the mouth, and the appendages which resemble short claws rather than legs. In many of the species the eyes are raised on stalks and can be moved about like lamps on a flexible arm, but there are others where the eyes are not raised, or, if stalked, are not movable. The mouth is, of course, different from that of a mammal or of any other backboned animal, for in the crabs we have an organ made up of three pairs of jaws, mandibles and maxillæ, which are simply modified limbs.

QUAINT LITTLE LIMBS WHICH HELP THE CRAB TO BREATHE

Such a mouth cannot seize its prey like the carnivorous mammal, but it must be fed and stuffed by the powerful pincers. But, for all that, it is efficient for the work it has to do. Breathing is by gills, but there are wonderful modifications in species which live mainly ashore. Small appendages near the mouth are kept in constant motion in order to secure a regular current of fresh water for the gills. There are special senses, too, in these quaint-looking little limbs.

With these the crab feels and smells. Wonderful that all these offices should be discharged by limbs inclosed in a hard shell. That shell, by the way, is not like the shell of a periwinkle or an oyster, nor does it match the horn of a bison or the bone of a deer's antlers. It is somewhat like horn, a special development of that wonderful substance, chitin, which affords a covering of mail to insects, and even lines their interior.

The crab is not born with this coat of mail. It begins its career in an egg attached to the limbs of its mother, and when hatched is a speck of life inclosed in a tough little membrane. We should never dream, until instructed, that the baby crab is a crab at all, so completely unlike the adult form is it, with a streaming long "beak," a sort of cap over its back, and an eye out of all proportion to the diminutive body.

If it escapes the peril of other crabs and the fishes and sea birds, our little crab slowly comes into possession of its first shell. That has to be changed repeatedly, much more often than the skin of a caterpillar is changed.

HOW THE CRAB WITHDRAWS FROM ITS COAT OF MAIL

For, like the caterpillar, the crab cannot grow without exchanging its outer covering for a new one. When the shell is fully filled, the little crab finds its mail split down the back. Tightly fitted in as he is at every joint, he withdraws each leg in turn from the shell, like a boy taking off his shoes. Then he liberates the body, one half at a time, and is a helpless little fellow in danger lest some hungry enemy may come up and find him a tender, tempting mouthful. The crab must lurk in secret places till he is newly mailed and fit to face the world and its dangers. Very poorly he must feel at such times, for not only does his entire shell come off, but he even molts the coats of his stomach.

We must suppose the crab's sense of smell to be acute, for, unlike the lobster, which likes its food "high," the crab will take nothing but fresh meat, unless sorely pressed. Therefore, as its watery home must be rather gloomy, we take it that its "nose" must be very sensitive to guide it to the bait to which it scurries. It will eat fresh meat; it will catch and eat fish.

One of the crabs commonest to our shores is the Green Shore Crab, but many of us know rocky pools and sandy bottoms which are inhabited by edible Rock Crabs or Blue Crabs. One remembers testing the appetite of an anemone; the creature swallowed eleven little edible crabs as big as quarters at a single meal!

Green Crabs and Rock Crabs are nothing in the way of swimmers, like the Blue Crab; they walk and crawl, and few of us realize how wonderfully agile they are. Like little marine life-guardsmen with their cuirasses on, they seem incapable of anything but the stiffest motion. But when they are cornered in shallow water they will dodge sidewise like lightning as one attempts to grasp them.

HOW A LITTLE HERMIT SOLVES ITS HOUSING PROBLEM

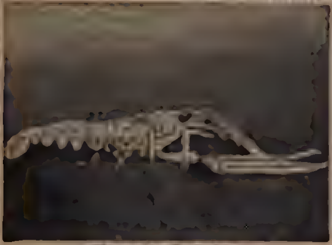
We must not expect feats of this sort from our Hermit Crabs, for they have to carry with them a burden not their own. They are born with the back part of their bodies quite defenseless, though the fore part has its mail, and the claws are as strong as any other crab's. They fear to be pinched in halves, so they have to hunt for homes.

Whelk shells are generally most desired. They prefer an empty one, but, driven to an extremity, they will attack the owner, tear it to pieces, and then take possession of the liberated shell. Hermit crabs have their housing problems as permanent and perplexing as our own.

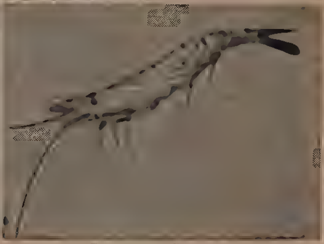
A GROUP OF LITTLE ARMORED CREATURES

Common Lobster.

Spiny Lobster.


Norway Lobster.

Long-beaked Spider Crab.


Common Shrimp.

Land Crab.

A Giant Spider Crab.

Cocoanut Crab.

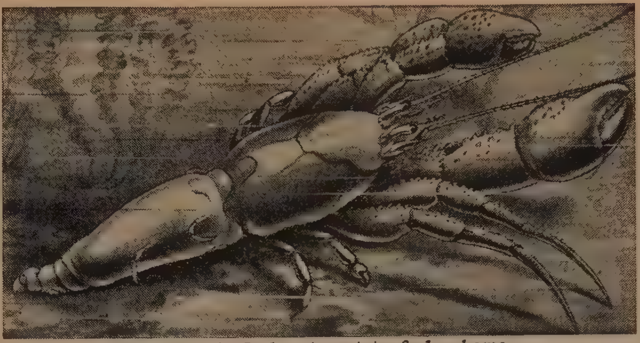
Hermit Crab.

Edible Blue Crab.

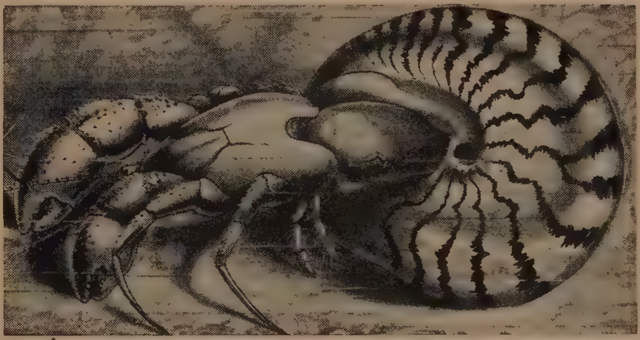
Common Green Crab.

Three little Pea Crabs.

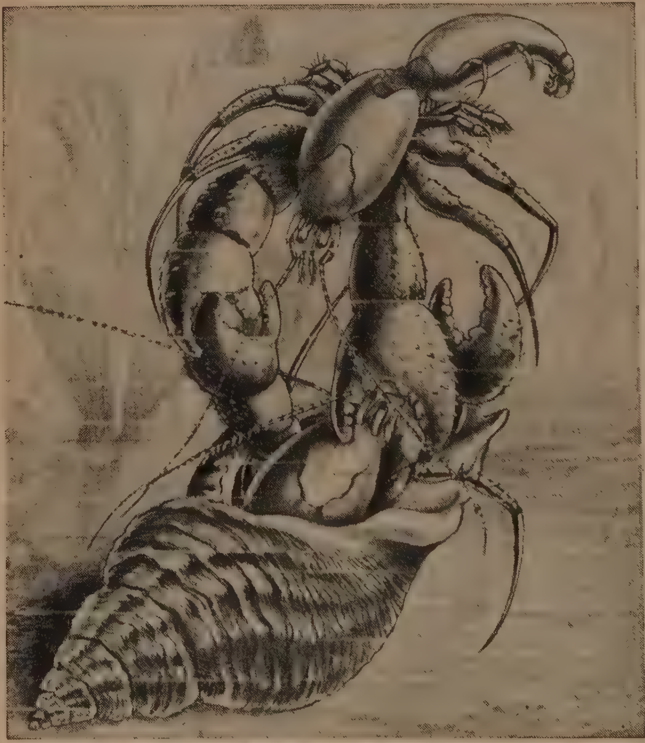
The pictures on these pages are by Messrs. S. C. Johnson, E. Step and the American Museum of Natural History.



The Hermit Crab sets out to find a home.



He discovers an empty shell and crawls into it—backward.



Growing too big for his house, the crab fights another crab for the possession of a larger shell.

Once in possession of the borrowed home, they insert their tails, which curl around and fit into the whorls of the fortress, while some of their foot-like appendages fasten like pincers to the walls. The hermit in his shell must have an anemone on it, and the anemone is willing. With the hermit half in and half out, and an anemone mounted on top, together they go roaming in search of food.

PARTNERSHIP OF ANEMONE AND HERMIT CRAB

The anemone stings the enemy of the hermit; the hermit is a pack-horse carrying the anemone to food. It is one of the most marvelous partnerships in the wilds. An anemone is one of the lowest of animals, yet it has this extraordinary understanding with the hermit crab. If we wish to dislodge an anemone from a shell, we must tear the lovely little monster to pieces; but when the crab has grown and must find a larger shell, he dismounts the anemone, takes it with him, and mounts it on the new one. How can we account for such agreements between creatures so low in the scale of existence?

Crabs are camouflage-artists. Some of them take sponges instead of anemones for partners; some rob the sea squirt of his tunic and wrap up in that; some, like the spider crabs of our deeper waters, bedeck themselves with seaweed so that they cannot be suspected of being crabs at all.

They scissor-off cuttings of the weed or of sponge, plant them on their shells, and the cuttings grow where they have been placed, and a moving garden of weed masks the crab within. Having noted that some of our common crabs are crawlers rather than swimmers, we must remember that there are crabs which swim powerfully. The so-called blue crabs are of this group, and swim with their oar-like feet. We have several species of swimmers in American waters, but the common edible Blue Crab of our markets and the mottled Lady Crab are the most common.

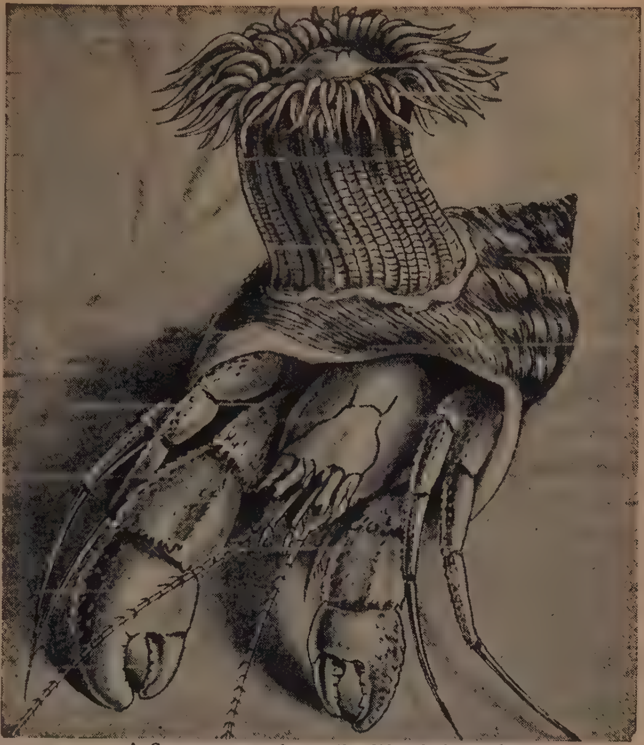
Our waters contain some notable species in the spider-like Slender-beaked Crab, the great Thornback Spider Crab, and minute Pea Crabs which, instead of carrying about anemones or sponges or seaweed, take up their residence within the shells of our common bivalves, living safely in an animate fortress whose food they share.

But let us go into the tropics and take a look at the land crabs. We come to creatures which must still go down to the sea to lay their eggs as frogs must go back to pond and ditch for the like purpose, but they themselves, like those amphibians, drown if confined to the water. One which lives on the verge of the sea burrows into the sand; then, having roughly made its hole, it ejects a strong stream of water from its gills, so clearing a passage for breathing, and is content.

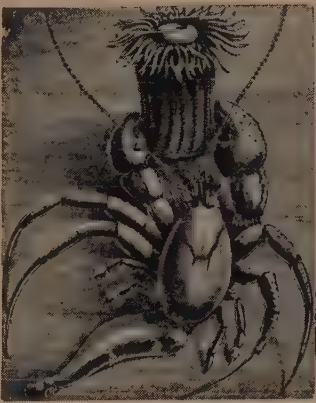
Other crabs go miles away from the sea. Some of them are best known to us by the famous Calling Crab, a title coming from the fact that the crab has one of its foremost claws hugely developed and carries it high and forward when running in such a manner as to suggest to onlookers that it is beckoning someone.

CRABS WHICH PICK UP A HOME AND CARRY IT

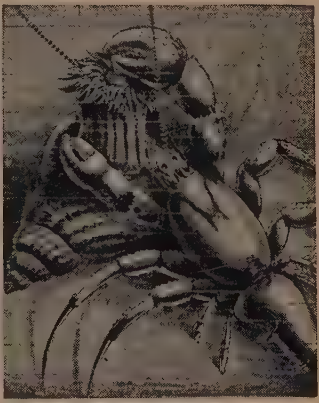
These crabs live ashore except for the egg-laying



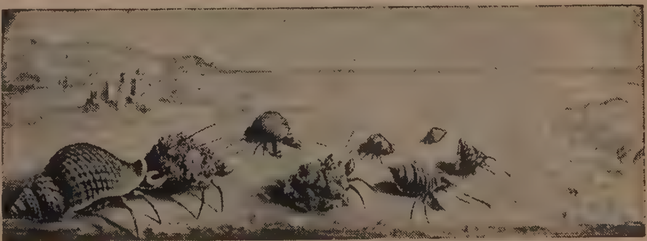
A Sea-anemone shares the life of the crab.



Changing his home, the crab takes his lodger with him.



The crab establishes the anemone on the new house.



Shells and sponges out for a walk on the seashore.

period. Congregating in swarms, they make great burrows in the sand, like rabbits, combining their efforts with intelligence and art. Experience teaches us not to look for our crabs far from sea, but in the tropics there are hermit crabs which take up their homes and walk far inland. They carry with them large turbo shells. Travelers have found these shells, some empty, some containing the hermits which transported them, a thousand feet up a mountainside, and one severely bit a naturalist who sought to gather something high up in a tree.

Then there are land crabs which crawl about dry docks and do not go to sea—the *Grapsus strigosus,* a little horror, first given its due place by the naturalists of the Challenger expedition. While the party was fishing and bird-hunting on St. Paul's rocks they found themselves surrounded by swarms of crabs, which stole the bait and carried off the fish as they lay new-drawn from the waters.

That was not the worst. Nesting terns had been driven from their young in order that these might be examined, so a big old crab waddled into a nest and seized and carried off a plump young tern to devour it alive at leisure. On Pitti Island, in the Indian Ocean, the traveler tells us, the ground is thick with the remains of young terns, some reduced to clean-picked skeletons, all murdered by crabs. Other crabs regularly raid rabbit warrens, and still others banquet on coconuts. The palm-hunters are usually known as robber crabs.

THE ROBBER THAT CLIMBS UP A TREE IN SEARCH OF FOOD

It had long been known that the Robber Crabs fed on coconuts, but that they climbed the tall palms in pursuit of their booty was deemed a traveler's tale. It is quite true. But how are the crabs to obtain the meat of the nut, inclosed in a very hard shell, and that in a dense husk of fibre? Having climbed his tree and brought down his prize, the crab tears off the fibre strip by strip, then hammers out the "eyes" of the nut with his great claws. Having gained an entry, he inserts his thin hinder claws, and with these drags out the contents of the nut. These robber crabs, big blue fellows, more like lobsters than crabs, can bite a man's finger off, as members of an eclipse expedition in 1922 found out at Christmas Island, in the Indian Ocean.

There are land crabs which, when they make their annual migration to the sea, go as straight as lemmings on the march. They swarm over houses; they swarm through them. The Christmas Islanders found themselves bitten in their beds as the swarming crabs made their pilgrimage to the distant ocean nursery. The whole land is covered with them as they swarm.

Then there are the land crabs of Trinidad. Travelers have told of the swarms of yellow-and-pink crabs, with dead yellow staring eyes, peeping from behind every nook and boulder, as if to say, "You drop down among us and we will do the rest."

Mr. E. F. Knight saw those same crabs of Trinidad, and with two comrades, as they lay in their tents that night, was the victim of a massed assault by the little wretches. They began to gnaw the sleepers as they lay. "They would have devoured us had we not awoke; as it was, they did nibble holes in our clothes."

THE GIANT CRAB WHICH USED ITS CLAWS AS A FORK

Nothing more grim has ever come out of Trinidad than Mr. Knight's picture of these crabs, which, as the three adventurers landed and cooked their evening meal of fish, swarmed in multitudes down the mountainside. They were fearful as the firelight fell on their yellow faces fixed in a horrid grin. "We threw them lumps of fish which they devoured with crab-like slowness, yet perseverance."

> A huge beast (continues Mr. Knight) was standing a yard from me; I gave him a portion of fish and watched him. He looked me straight in the face with his outstarting eyes, and proceeded with his two front claws to tear up his food, bringing it to his mouth as with a fork. But all the while he never looked at what he was doing; his face was fixed in one position, staring at me. And when I looked round, lo, there were half a dozen others all steadily feeding, but with immovable heads turned to me with that fixed basilisk stare. It was indeed horrible, the effect nightmarish in the extreme.

After all their feed of fish, it was these same monsters that attacked the sleepers as they lay in their tent that night.

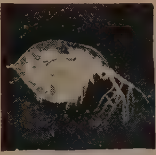
THE LOBSTER HAS NO SUCH HABITS AS THESE

The Lobster is guiltless of all such charges as these, for, though his claws are prodigious in size and power, no lobster does such things. All the ingenious men, says Charles Kingsley, all the scientific men, and all the fanciful men in the world could not invent anything so curious and so ridiculous as a lobster.

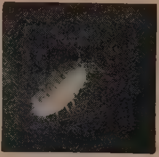
There are many structural differences between the lobster and the crab, though their relationship is as plain as their differences. The lobster is long-tailed; the crab short-tailed. In the lobster the tail is a powerful organ of propulsion. The lobster is commonly supposed to use the tail only to project itself backward, but the organ drives the creature forward as swiftly as rearward.

BABY LOBSTERS ARE HATCHED AND LEFT TO FEND FOR THEMSELVES

To that broad tail the eggs are attached, the berries, as they are called. From these the little ones emerge, and though about the size of mosquitoes, are at once dispersed and rise to the surface of the ocean, where they remain till after their fourth molt, when they sink to the sea-floor to become bottom-dwellers.


Water-flea.

Sand-hopper.


Wood-louse.

In life the lobster is a greenish blue; boiled, its coat of mail turns a brilliant scarlet. They are caught in traps called lobster pots, attracted by a bait of fish or strong-smelling flesh. They fight among themselves in the pots and bite one another's claws off, so that, if storms delay the visit of the fisherman to his pots, he is certain to find his captures badly maimed when he hauls them up. To prevent such battles en route to market he ties their great pincers together, or else drives pegs into the joints.

A ship's Barnacle inside its shell.

But lobsters and crabs do not always wait for battle to lose their claws. The lobster, in a state of panic, casts his claws. The crab can discard an entire leg—several legs, in fact—whereas the lobster's power is limited to the great pincers. But pincers or legs, they can be renewed in the same way as the limbs of an injured starfish. Lobsters are becoming scarce in our waters in spite of all efforts to increase their numbers.

THE CRAYFISH, WHICH LIVE IN FRESH WATER

Crayfish (often called crawfish in some sections) are the fresh-water representatives of the family. They resemble the lobster in outline, though not in color, and lack the huge fore claws. They are in many a canal and river which we do not suspect, for they come out to feed only at night, lurking by day under stones or in holes in the banks.

When the sun is down, forth come the crayfish in quest of worms, insects, small frogs, fish and vegetation. They obviously hunt by scent, for when men go out to catch them, they bait their hooped nets with a dead fish which is decidedly strong. The net is a rough-and-ready contrivance modeled after the shape of an eel trap.

The crayfish is not prolific like the lobster, which lays as many as 100,000 eggs a season, while the crayfish's eggs may number 200; but there may be only a single one, and it takes five years at least for one of the creatures to reach maturity, though after that they may live another fifteen years or so.

In winter they are sluggish, hidden in some recess in the bank, with claws outstretched to seize unsuspecting prey. But the dead season is a busy one for the mother, as it is then that she lays her eggs so that they may mature and be ready for hatching as spring brings warmth to the waters of the crayfish's home.

Country boys find the holes of the crayfish in low ground by the little rings of earth brought up and arrayed in a circle around the hole. These holes go down to the water-level, and the crayfish remain hidden during the daytime. On the Mississippi and on other rivers which have levees or banks to keep the water from spreading over the land, crayfish often do much damage by opening passages for water. The flowing water makes these larger, and the whole bank may be swept away unless the hole is discovered at once. They sometimes injure the banks of canals in the same way.

THE MANY SPECIES OF SHRIMPS AND PRAWNS

Next in the order come the shrimps and prawns, active swimmers, whose powerful tails impart a sort of leaping motion through the water. Both match their surroundings, either by resembling the ground over which they swim, or being almost transparent, or even changing colors to suit environment. Shrimps are common in fresh water, but we draw our supplies from the seas—supplies so great as completely to defeat all attempts at calculation in numbers.

The Prawns, which are larger, keep farther out from the shore than the shrimps, but both have representatives down in the oozy, unlighted abysses, and there, three thousand feet deep in the Indian Ocean, various species of prawns have been discovered endowed with the art of light-making by means of lovely phosphorescent lamps fashioned from certain glands in their antennæ and along the sides of the body.

Shrimps convert garbage into wholesome food as a vine converts manure and soil into grapes. Extraordinary forms are found in their family, some like skeletons, some with long necks with huge eyes mounted on far-reaching stalks, some with great lobster-like pincers, some fashioned like the praying insect and catching prey with claws of the true mantis type.

Most of the shrimps we eat come from southern waters, where the industry is important, and many are preserved in tin or glass. On the Pacific coast many of one species are dried and sent to China, where they are highly prized.

THE WOOD-LOUSE WHICH CURLS ITSELF UP IN A BALL

We pass on to Wood-lice which, although they are true land creatures, must have moisture, whether they are eating up rotting wood or devouring our maidenhair ferns or tomato plants in the greenhouse. To speak of their eating tomato plants is not an exaggeration. When the tender seedlings are first planted out it is no uncommon thing for a wood-louse to cut down the entire plant as neatly as a woodman cuts down a tree.

As we all know, there are wood-lice which do not curl up and wood-lice which do. The species which rolls itself into a ball is called the Pill Wood-louse. All wood-lice in the wilds turn rubbish and decay to the support of life; but in well-tended gardens and conservatories they are a scourge to the cultivator, and most difficult to eradicate.

We go down to the sea again, to make mention of near allies in the Sand-hoppers. In the sand, under seaweed and other gifts of the sea, these little scavengers swarm. Practically anything organic is food to them. They do not invade our homes and gardens, but eat and eat, day and night, what would tend to make the shore unsavory. Great leapers, they are themselves food for crabs and shore birds. They are good friends to us, though very alarming to nervous people.

THE TINY CREATURES THAT KEEP THE WATER PURE

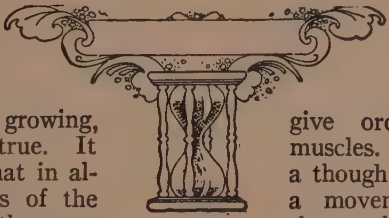
They are numerous enough, but their fresh-water allies, the Water-fleas, are like the sands of the shore. There are many species of them inclosed in double-shelled defenses, and their life-history is full of interest. Here we can but give them credit for purifying the water of decaying animal matter and for devouring masses of minute vegetable growths.

Omitting many other forms, we must note the Barnacles as belonging to our present company. The barnacle, which is a member of the group of animals technically known as stalked *Cirripedia,* undergoes many changes in the course of its career, finally anchoring itself by its head to ship, floating timber, or other point of vantage, and gaining a living by kicking its food into its mouth with its curious curved legs. The creature is of interest to us all from its habit of clinging to ships in such numbers as to slow down their pace through the water and making it necessary to send them into dry dock.

We must leave this interesting class without mentioning dozens of strange creatures, such as the Giant Crab of Japan, which is more than a foot across, with legs which sometimes are from fifteen to eighteen feet from tip to tip. Then there is the Opossum Shrimp, so called because it carries its eggs in pouches between the legs. The smaller forms which live in the sands are equally interesting.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6011.

CAN A BRAIN EVER GET FILLED UP?



NOT long ago it would have been said that after a certain age our brains completely stop growing, but that is not quite true. It has now been found that in almost all of the brains of the higher type of people there are a certain number of cells which have not fully developed so as to do any work, and which may develop even after we are fully grown up.

All this, however, is a mystery. It is certain that in the case of many people there is no real limit to what the brain can do and hold. Robert Browning made a great scholar in one of his poems say, "No end to learning"; and this is a motto the wisest men have always believed in. It is also certainly a motto which keeps people young, young at any age, and helps to prolong their lives.

What this question means is whether the brain can become so filled up with knowledge that it can remember no more; whether it can be so full that new facts packed into it must displace old ones.

Before we can consider that as a possibility we must ask what memory consists of and how the brain is affected by memory or thought. The brain consists of innumerable cells. Some of them are certainly storehouses of memory; others are connected with cells which set in motion nerves that give orders to the body's muscles. Every time we have a thought, every time we make a movement, there must be thousands of brain cells in action to register the thought that produces the movement; and every time there must be some wastage of them. But the body is always renewing the brain cells, and the brain as a whole wears out perhaps less than any other part of the body.

In the brain there is a wonderful division of labor. There are brain cells for receiving sensations, brain cells for giving orders to the muscles or the organs of the body, and besides these there are what are called association nerve cells (or *neurones*), which are far more numerous than all the rest put together and are the connecting link between the others. They are all found in one portion of the brain, and may be described as the nerve cells of experience. They register and keep a record of experiences and impressions conveyed to them by the other nerves, and they may, indeed, be regarded as the storehouse of impressions.

What they have done once they will remember partially to do another time, and when they have done it a great many times they do it very readily. If, on the other hand, they do not have practice in doing things they forget them. So, by the growing old of the association of neurones, the nerve cells of experience, the right hand may forget its cunning, or the memory may forget the year of Columbus's discovery of America or any other date.

Thus the brain may in a way get filled up, not because its experience cells can carry no more, but because new experiences, new impressions, new facts may have given them new things to do which they remember better than they remember others which went before.

Often when people grow old they remember best their childish experiences. That is perhaps because the experience cells, relieved from the pressure of new work, are able to recall their old ways.

WHY DOES MY FACE TURN WHITE WHEN I AM FRIGHTENED?

The skin of our faces has a certain amount of color of its own, but the main part of the color of the face—at any rate, in this part of the world—is the color of the blood shining through the skin. It is the heart that drives the blood through the skin of the face. When a person is frightened the nerves running from his brain to the heart almost stop the heart from beating, so scarcely any blood whatever is sent through the skin of the face, and we see the pale color of almost bloodless skin. Anything that interferes with the heart's beating will have the same result as fright: bad air, for instance, causing anyone to faint. When a person's face becomes extremely pale we should understand that there is a risk of his fainting, for if not enough blood is passing through his face, it is probable that not enough blood is passing through his brain. In some people, whose hearts are not strong, it is difficult to supply the head with enough blood.

WHERE DOES THE RAINBOW END?

As we trace the rainbow down on each side it seems to touch the earth, and there are stories of children who have set out to find the end of the rainbow. But the rainbow ends nowhere. It is a mere appearance in the sky, due to tiny drops of water, and it "ends," if we are to use that word, simply where the drops of water end that are so placed as to reflect the sunlight in this way to our eyes. Really no two people see exactly the same rainbow. They could not do so unless their eyes were in the same place. As we move, the bow we see moves with us.

DOES CAMPHOR KEEP MOTHS AWAY?

Camphor, like most other things that have a smell, is what we call *volatile*—that is, it gives itself off into the air in the form of a gas. Like many other volatile things, camphor is an *antiseptic*—a thing, natural or artificial, that is very bad for the lives of microbes. Oil of cedar is used for a similar purpose.

Now, most things that are poisonous to microbes are poisonous to insects. Indeed, as a rule, a poison to any kind of life is a poison to all kinds. Camphor in large doses would kill a man. The camphor gives itself off into the air around it, and as it is very poisonous to moths, the moth flies away when it smells camphor. It is a great advantage when an antiseptic is volatile, and all the most useful antiseptics are so. If a thing is not volatile, it can have its effect only on things that touch it.

But if an antiseptic is volatile, it flies about in the air, and the farther it spreads, the weaker it becomes. Insects or microbes can get within a certain distance and not suffer, but they cannot go nearer without being killed. Every antiseptic we use to preserve clothes by putting it in a drawer will therefore protect all the contents of the drawer.

WHAT IS THE MEANING OF ST. VALENTINE'S DAY?

The fourteenth of February is called St. Valentine's Day, as the name day or feast day of eight different Christian martyrs named Valentine; that is, in the medieval church, services were held on that day in memory of their martyrdom. The custom of sending valentines or gifts has nothing to do with the martyrs, however. It happened that a springtime festival which was kept by the Romans fell on the same day. The making of gifts on that day has come down from this old festival; but the origin of the custom was generally forgotten, and in time the gifts were called valentines from the name given to the day. This is a good example of the way customs survive, sometimes for centuries, among people who do not remember how they arose.

HOW IS THE DATE OF EASTER FIXED?

In early times all countries did not keep Easter on the same date. The churches of Asia Minor celebrated it on the same day as the Jews kept their Passover, while the churches of the West, remembering that Jesus rose on a Sunday, kept Easter on the Sunday following the Passover day. Various attempts to reconcile these two practices failed, and then the Council of Nicæa passed a decree that everywhere the great feast should be observed upon the same day, that day to be the Sunday following the Jewish Passover. To prevent further disputes, four rules were laid down for the fixing of the date.

It was decided that March 21 should be regarded as the spring equinox—the time in spring when day and night are equal; that the full moon on that date, or the next after that date, should be taken for the full moon of the Passover month; that the Sunday following full moon should be Easter Day; and that if the full moon happened on a Sunday Easter should be the Sunday after. This plan has been observed ever since, and by it the date of Easter is fixed.

In carrying out the arrangement for the fixing of Easter various difficulties have arisen during the centuries owing to the fact that the moons do not correspond exactly with the calendar. A series, or cycle, of 19 years has therefore been taken and numbered from 1 to 19, the numbers being known as Golden Numbers. Then to each of these years has also been given a number which is the age, reckoned in days, of the moon at the beginning of the year. The numbers in this second series are known as Epacts, and from the Golden Number and Epact the full moon for deciding the date of Easter in any year may be worked out.

It is curious that in arranging the date of Easter according to rule, the spring equinox is a calculated date and not the actual spring equinox; the moon referred to is not the actual moon shining in the sky, but a mathematically calculated moon; and full moon does not mean a complete circular moon, but a supposed full moon according to certain averaging over a course of years. All this is due to the imperfections of the calendar, which never corresponds exactly with the real movements of the sun and moon.

By means of the Golden Number and the Epact, which can always be found in any good almanac, a clever boy or girl can work out the date of Easter for any year. The earliest date on which Easter Sunday can fall is March 22, but that will not occur till the year 2285, and the latest possible date is April 25, which will next fall in 1943.

The reason nineteen years are taken to form a cycle for reckoning the Golden Numbers is that after nineteen years on a given day of the month the moon is approximately in the same position in the sky as it was nineteen years before, so that nineteen forms a complete series.

WHAT IS MEANT BY GRAFTING?

Grafting is the process by which two or more varieties of fruit can be made to grow on one tree. The size of the stock usually determines the method to be followed. A common form is that of cleft grafting. For this a small branch—little more than a twig—about half as thick as the little finger, is cut from the bush or tree which we desire to graft on another tree. This must be done in the early spring, and the grafts should be placed in a cellar or other cool place for a few days. The little branches are cut into lengths of about nine inches, and each graft should contain three buds of the last year's growth. The end to be inserted in the wood is cut in the shape of a wedge.

When the time for grafting comes, the branch upon which the graft is to be made is cut back, a slit is made and held open by a small wedge. Then a graft is placed at each end of the slit, and pushed in tight. The wedge is removed; grafting wax is spread thickly over the wound, and for added protection during the time of healing a white cloth is wound over and around the branch.

Two grafts are used because the wound in the branch heals more quickly if both ends are closed, and the chance of obtaining a successful growth is doubled. Luther Burbank makes his grafts on very small branches. In placing the grafts care must be taken to see that the cambiums of both stock and grafts come together, otherwise the graft will not grow. The graft is technically known as the "cion" or "scion." The cambium is the layer of growing tissue which lies within the bark, the "soft living part."

WHAT DO WE REALLY MEAN WHEN WE SAY WE DON'T CARE A FIG?

In the phrase *"I don't care a fig,"* the word "fig" means *fico,* the Italian word which means a snap of the fingers.

ARE PICTURES OF THE THINGS WE SEE PRINTED ON THE EYE?

The word photograph means "light-picture." That is exactly what photographs are—pictures printed by the light on a film or a plate. This film is covered with chemical substances which light affects according to its power and the place where it strikes. The retina, or back part, of the eye is in these respects the same as the photographic plate. It also contains chemical substances which are changed by light. Therefore it is true that pictures of what we see are printed or mirrored on the retina of the eye.

But there is a tremendous difference between the retina of the eye and the plate of a camera. If the picture printed on the eye stayed for any length of time we could not see anything moving. If our eyes are to be useful it is necessary that the pictures printed on them should rapidly pass and be replaced by others. This is where the wonder comes in. In a tiny fraction of a second the back of the eye continually remakes from the materials supplied it by the blood the chemical substances which are affected by light.

WHAT MAKES THE CURRENTS WHICH FLOW THROUGH THE SEA?

A current is not the same thing as a wave, which, though it seems to move onward, is really due to the water's moving up and down. After the wave has passed, the water is in the same place as it was before. But in the case of a current, the water is actually moving from one place to another. There is a lake in Switzerland through which a river runs, and by the difference in the color of the water you can see where the river is. In that case it is easy to understand what makes it. The water of the river is falling to the sea, which is lower down than the place where the river started. It is really the earth's attraction which is pulling the water of the river through the lake and making the current.

In the sea, currents are due to something which is pulling or pushing part of the water through the rest of the water. These currents may be due to various causes. Sometimes it may be a steady wind blowing for some time in one direction, driving some of the water before it. More often, perhaps, currents are due to differences in the heat of the water. Warm water in cold water will keep to itself, so to speak, and will move through the sea. If the sun shines brightly on a particular part of the sea it makes the water there hotter and so may start a current. Indeed, the currents of water in the sea are often due to very much the same causes as the currents in the air.

WHY DOES HOT WATER TAKE UP MORE ROOM THAN COLD?

It is not true that in all cases water expands when heated. If we take water at 32° Fahrenheit, the freezing temperature, and then slowly heat it, we find that it shrinks until it reaches 39.2° on the same thermometer. That, however, is a special exception. It is perfectly true that if we go on heating the water after 39.2° Fahrenheit, it does expand and take up more room. This is true of almost anything, whether a solid or a liquid or a gas.

We can find some kind of explanation for this if we think of heat as a to-and-fro motion of the tiny parts of which all matter is made. The hotter the thing, the wider is this to-and-fro motion of its tiny atoms.

Suppose we have a crowd of children, and all the to-and-fro motion each of them makes is just so much as is required for breathing. Fifty such children could be packed into a very small space. If, instead of making only this little movement, each of them wanted to be making little runs of five yards backward and forward, we should plainly not be able to pack these fifty children into as small a space as before.

If, instead of children, we think of the atoms of matter, and if we think of heat as sending these atoms of matter running to and fro, we shall see why water and other things swell when they are heated. No one knows what special arrangements are made in the case of water between 32° and 39.2° Fahrenheit.

HOW MANY STARS ARE THERE IN THE SKY?

Astronomers believe that the number of stars in the sky is about three hundred millions, though in the Great Star Map now being made by the observatories of the world fewer than half a million have been counted and numbered. If all the dark stars that can never be seen were added, the numbers would be far greater. Some astronomers think they may number as many as eighteen hundred millions. But these are all guesses at truth.

WHY CANNOT WE FLY IN THE AIR AS WE SWIM IN THE WATER?

The problems of swimming and flying are exactly the same in principle. In both cases the body is heavier than the thing around it, and the problem is somehow or other to prevent it from sinking. In swimming the water around the body is much nearer the heaviness of the body itself than is the air, and so the task is much less difficult. It is still less difficult in sea-water, because sea-water is heavier. It is possible, however, for a bat to fly, and the bat is an animal built on much the same principles as ourselves. Every airman knows what the bat appears to know—that if we want to fly we must expose a large surface to the air, so as to get all we can out of the supporting power of the air. The bat has enormously long fingers of the same pattern as our own, with a web stretched between them. Thus provided with two useful airplane wings, it can fly. We really see the same thing, as regards swimming, in the case of many web-footed birds, web-footed frogs, newts and other similar creatures.

WHAT IS ADAM'S APPLE AND WHERE DID THE NAME COME FROM?

Adam's apple is the name given to the lump in the front of the throat. It began with the old nonsense which said that a piece of the apple which Adam ate stuck in his throat and made this curious lump, It is really the front part of the larynx, and appears in boys when they are in their teens. It is always more prominent in men than in women.

HOW MANY WORDS ARE THERE IN THE BIBLE?

The Bible contains 66 books, of which 39 are in the Old Testament and 27 in the New. The Old Testament has 929 chapters, 23,214 verses, 592,439 words, and 2,728,100 letters. The New Testament has 260 chapters, 7,959 verses, 181,258 words and 838,380 letters. For the whole Bible the total is 1,189 chapters, 31,173 verses, 773,697 words and 3,566,480 letters. The Apocrypha contains 14 books, 183 chapters, 6,081 verses, 152,185 words and 1,063,876 letters.

The middle chapter of the Bible is Psalm CXVII, and the middle verse is verse 8 of Psalm CXVIII. In the Old Testament the middle book is Proverbs, and the middle chapter is Job XIX; but there is no middle verse as the number of verses is even; the middle comes between verses 17 and 18 of II Chronicles XX. In the New Testament the middle book is II Thessalonians, and the middle verse is Acts XVII, 17; but there is no middle chapter, owing to the even number. The middle comes between Romans XIII and XIV.

HOW MANY WORDS HAS THE ENGLISH LANGUAGE?

A dozen scholars might give as many answers to this question. One of them gave the number as 38,000, but a still greater scholar, Professor Max Müller, who was perhaps the greatest authority of his time on words, put the number of words in English at 100,000. He compared the growth and development of our language with the putting of grain in a sieve. Most of the chaff has been winnowed off, and with it have gone many good grains. Good old English words, which we now consider only dialect words, have gone out of the language. If we include all the words which have fixed places in the dialects of the country, and many which we know were spoken in earlier times, we shall have to put the total at over 300,000.

The number is constantly growing. Words have to be invented for new industries, and they become part of the language. When a new dictionary was made some years ago, it was found that the new words made necessary by electricity numbered over 4,000. A similar increase had taken place with regard to other arts and sciences. Most of them are purely technical words, but little by little they become common words as all of us get to know more about science. And so the language grows.

In ordinary reading and writing, of course, we do not use a tenth of the words in the dictionary. The average educated man uses from three to five thousand words, but a country peasant will manage very well with a few hundreds. Even some famous authors use a comparatively small number of words. Milton, for example, used only eight thousand, but Shakespeare used fifteen thousand.

WHAT IS A BAKER'S DOZEN?

A baker's dozen means thirteen. Bakers used to be heavily fined for giving short weight. So, to be quite sure that they were on the safe side they gave an extra loaf to every dozen.

WHY IS THERE A HOLLOW IN THE FACE OF A BRICK?

If we watch a bricklayer at work we notice that he places a lump of mortar on the last brick he has laid. Then he places on the smoothed-out mortar the next brick, hollow downward, so that it readily sinks into position. When it has dried, the mortar in the hollow becomes practically part of the brick. It helps to cement the brick more firmly to the whole, so that the completed wall is much stronger and more compact.

WHAT IS TO BLAME WHEN A TOOTH ACHES?

Headache, earache and toothache are caused by a great number of different things, most of which act on some special nerves, or on some part of the brain. The nerve tells the brain that something is wrong. The brain sends a message to the part of the body concerned. This gives rise to a feeling of more or less intense pain. Sometimes the nerve swells up. If it is in a tight place, the pain is very severe.

WHY DO TREES HAVE COATS OF TOUGH BARK?

If the bark did not grow on the tree, the tree would not grow. In the first place, the bark does one or two things which are important. The outside of it is usually pretty tough, and has become more or less dead (like the outside of our skin). Things do not hurt it and it protects the living part of the tree inside. The inside of the bark is the most living part of the tree. It actually makes the tree. All the growth of the tree in thickness is due to the making of the wood. It is the soft living part of the inside of the bark that has made all the hardest wood of the biggest and hardest tree-trunk. There are channels in the bark through which the sap of the tree runs, in much the same way as the blood runs in our own blood-vessels.

WHY ARE THE DOORS OF ROOMS GENERALLY IN A CORNER?

Centuries of experience have gone to make the building of the inside of a house, but the reason why doors are usually in the corners is really simple. They are put there because, except in very large rooms, it is desirable to give as great a width of wall as possible for furniture. An interesting thing to notice, however, is that doors are always hinged on the side where the greatest length of wall is, so that any draft that comes in is broken by the wall at right angles.

WHY DOES A TAILOR WEAR A THIMBLE WITHOUT A TOP?

The reason why thimbles usually have tops is because in ordinary sewing the tip of the finger is used to push the needle through the material. But tailors sew through such thick material that they have to use the side of the thimble to drive the needle. So their thimbles need no tops.

WHAT ARE THE LITTLE WHITE CUPS ON THE TELEGRAPH POLES?

These little cups are made of earthenware and known as insulators. Their object is to prevent the electric current from escaping down the poles into the earth. Wood and metals are what are known as good conductors of electricity. If they were used to carry the telegraph wires the current would at once pass through them into the ground and be lost. But some materials, such as earthenware, are bad conductors of electricity and are therefore used extensively as insulators.

WHAT WERE THE MINUTE MEN OF AMERICA?

At the beginning of the American Revolution the United States had no regular army, but many of the colonists belonged to the militia. When war broke out with England most of these militia men remained on their farms, but they pledged themselves to take the field when called upon at a moment's notice, thus earning the name of Minute Men. There is a monument to them at Concord, in Massachusetts. The noted sculptor Daniel Chester French designed this memorial.

WHY DOES A MAN TAP THE WHEELS OF A TRAIN AT THE STATION?

The men who tap the wheels of trains at railway stations are called car-knockers, and their business is to see that none of the wheels are defective before the train goes on. If the wheel is in good condition it gives out a clear, ringing sound. Should either the wheel or the axle be cracked or broken, it gives out a cracked sound when it is tapped. The car-knocker is thus able to discover very quickly the condition of the wheels. As serious accidents may result from defects, his work is very important.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6173.

Wells Cathedral.

GOTHIC ARCHITECTURE IN ENGLAND

THE earliest buildings of any importance in England date from the Norman period. This really began before the Conquest, in the reign of Edward the Confessor, who was educated at the Norman court. Before this time there are a few Saxon buildings of simple style, naturally influenced by the Roman occupation. Of Roman work only ruins now remain: scraps of London Wall, Hadrian's Wall, mosaics, bath-chambers, and so on. But we know there were temples, basilicas and villas in the Roman towns of Britain, just as there were in any other country which those great builders conquered.

Saxon work exists for us now in a number of churches, like those at Worth, Sussex, at Escomb, Durham, St. Lawrence, Bradford-on-Avon and Brixworth in Northamptonshire; and towers like Earls Barton, Northampton and Barton-on-Humber. But there are also many hidden Saxon remains in churches of a later style, and these are often not discovered until there is some reason for laying bare the old foundations.

The first important building of the English Romanesque, or Norman, style was a new church called the West Minster, dedicated to St. Peter, built by the Confessor. There is a tradition that the oldest church reared on this site was a Saxon building set up about 616. In 960 St. Dunstan refounded a Benedictine monastery there. A hundred years later the Confessor began the work of rebuilding and strengthening. He was buried in the church in 1066. We shall presently see how later rulers continued the work he began.

The Normans who settled in England after the conquest by William were, like the rest of their race, an intelligent, powerful people, capable of great mental elasticity, and with a natural feeling for beauty. They were Christian, but none the less fighters; and from their combining a lofty motive with a soldier's skill sprang the chivalry of Norman England and France. From their vigorous Christianity and desire to see some monument of their faith established sprang the lovely churches of the period, built on the same lines as those of Normandy.

The English Channel was never a wide waterway, although we seem to consider it as a great barrier; and in the days when it divided Norman England from Norman France—the days of almost impassable roads and easy sailing—it was a little strait, continually being crossed. Thus into England came more and more of that European influence which had begun when Edward the Confessor, educated at the Norman court, became king. Stonemasons and woodcarvers, craftsmen in metal and different kinds of workmen, came over in considerable numbers, and brought not only their tools, and probably their families, but also their ways of thinking, and such education as the religious architecture of northern France had given them. The men who had planned the great Norman churches continued their work in England.

THE NEW STYLE OF ARCHITECTURE WHICH AROSE IN EUROPE

They loved unbroken masses and semicircular shapes, as we can see from their walls and rounded arches, piers and columns. They disliked a line broken up for a small and pretty effect. But before they had well established their new churches among the greenery, the rivers and fens of England, before five successive Norman rulers had had time to consolidate their power, the spirit of architecture in Europe had changed. Romanesque had given place to Gothic, and the fever, spreading over the Continent, seized England.

But by this time a number of magnificent cathedrals and churches had been set up; and though almost all of them served merely as the core of a later Gothic building, here and there we can see something of the work of the early builders of England. In the cathedrals of Canterbury, Winchester, Rochester, Ely, Hereford, Norwich, St. Albans, Worcester, Oxford, Chichester the touch of Norman builders is to be seen in choir, nave or tower.

They reached their height in Durham Cathedral. This wonderful pile was, of course, added to later, but Time has been kinder to Durham than to many of the cathedrals of that wonderful century following the settlement of the Normans in England. There is nowhere in England a more beautiful sight than the Norman nave of Durham Cathedral, with its fluted and spiraled columns.

THE WONDERFUL CHURCH FOUNDED BY A KING'S JESTER

Peterborough is another great cathedral which is Norman at heart, and the abbeys of Waltham and Tewkesbury point to the same inspiration.

In London there are two particularly fine specimens of these great masters' work, the White Tower with the little chapel of St. John, in the Tower of London, and St. Bartholomew the Great, Smithfield. This church is part of an Augustinian priory which, with the hospital near by, was founded in 1123 by Rahere, court jester in the reign of Henry I.

Rahere was very ill in Rome, and he vowed a vow to God that if his life were spared he would build the finest priory in London next to that of the Benedictine monks at Westminster. Rahere's tomb is in the church (added some three hundred years later), and as we look at it we cannot help feeling glad that this witty courtier was spared to erect such a monument of gratitude as the priory of St. Bartholomew. He fulfilled his vow in a superb style, unstintingly, and the work that he left uncompleted his successor finished.

The church is all that is left of the priory, whose conventual buildings, lying on the south side—cloisters, refectory, chapter house, dormitory—have long been destroyed or have served as foundations to other buildings. And that which is called the church is really only half of it.

THE CHANGES THAT HAVE COME OVER ST. BARTHOLOMEW'S

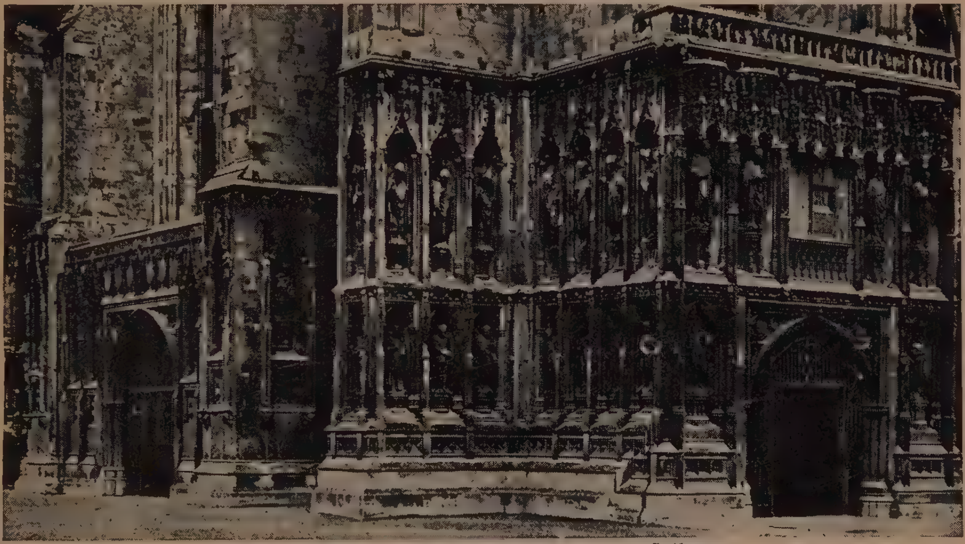
We can get some idea of its original size if we remember that the place where we enter a modern doorway in a seventeenth-century tower was where the transepts crossed the nave. Thus we walk straight into the choir itself, which is larger than many churches, and gives an impression of solemn grandeur, with its massive round columns and semicircular arches. The place where the nave stood lies outside the present church wall, a bare stretch of stones reaching from the door to the pavement of Smithfield.

The long vista of nave and choir, with the lady chapel beyond the apse, ranked like a forest with massive columns, must have been one of the finest things even in those days of beautiful churches. And we are intensely thankful that even a part of this magnificent church remains. It has passed through more than usually troubled days. At one time the north transept was used as a blacksmith's forge. The lady chapel has been a printing-works and, later, a factory. In 1896 it was rebuilt. Such of the conventual

THE SPLENDID CHURCHES OF ENGLAND

The crypt of Canterbury Cathedral.

The Galilee chapel in Durham Cathedral.


The south porch and west door of Canterbury Cathedral.

The entrance to the chapter house at Bristol.

The pulpit and organ in Temple Church.

The north aisle of Durham Cathedral.

buildings as are not destroyed are being cleared of added buildings—one of them a stable—and before long the ruins of this unique pile will be able to tell their own historic tale.

There have been additions and alterations in successive centuries, but, mercifully, not to any great extent. A perpendicular clerestory rises above the Norman blindstory, or triforium—the part of the wall that lies above the pillars of the aisle and below the aisle vaulting that supports the roof. A gallery sometimes runs behind the blindstory. It is called "blind" because this part of the wall is marked by rows of arches through which no light comes. And the blindstory is also called the triforium because inside the arches are usually set three other little arches (*tres* means "three," and *fores*, "openings"). The clerestory and blindstory, or triforium, have been very important features of architecture from Norman, or Romanesque, times to our day.

THE ROUND CHURCHES THE CRUSADERS INTRODUCED INTO ENGLAND

A most interesting little side development of Norman architecture was the round church. These builders loved circular lines; hence their "wheel" windows, whereof so few remain. But it is probable that the idea of the round church, which Romanesque workers on the Continent set up in imitation of the circular baptisteries, was introduced into England by travelers and Knights Crusaders who had seen the buildings of Southern Europe, and particularly the Church of the Holy Sepulchre at Jerusalem.

Very few of the circular churches are left. There is St. Sepulchre, Cambridge; one at Northampton; another at Little Maplestead. The most famous is the Temple Church, London. Since early in the fifteenth century the Temple—a large area containing squares, gardens and halls—has been one of the Inns of Court. Before that time it was the headquarters of the Knights Templars, the most chivalrous order of Norman times.

THE BEAUTIFUL ROUND CHURCH THE NORMANS BUILT IN LONDON

The round church of the Knights Templars was consecrated in 1185, at a time when Romanesque was merging into Gothic. Hence it is called Norman transitional. The original apse that carried the choir out from the circular nave has been replaced by a very fine early Gothic choir. The entrance porch and doorway and beautifully carved door are most delightful specimens of Norman skill. Under the gracious round curve we pass into the round church.

Here restorers have been obliged to repair Time's ravages. But they have labored skillfully, and thanks to them the pile remains seemingly as it was left some seven hundred years ago.

Marble monuments of nine Templars fully armed lie in the church in front of the clustered marble shafts that uphold the roof. They lie as if asleep, and are variously posed. Those whose ankles are crossed had been on one Crusade only; those whose knees are crossed went twice; those whose legs are crossed still higher are knights of three Crusades.

It is impossible not to feel the mysterious power of beauty and history together as we stand in the Temple Church, particularly if it should happen that we are there on the afternoon of the last Sunday in the old year when, by long custom, the choristers leave their stalls in the chancel and make a ring in the round church by the sleeping knights, and sing the oldest carols of our Christian faith. The fingermarks of history are plain in the Temple. Two of the stops in the organ were put in by the "infamous" Jeffreys. Outside, in the garden, grew the white roses and red wherefrom the quarreling Yorkists and Lancastrians plucked their badges.

> This brawl to-day,
> Grown to this faction in the Temple garden,
> Shall send between the red rose and the white
> A thousand souls to death and deadly night.

THE SPIRIT OF THE CRUSADERS WHICH HAS GONE FOREVER

But most of all we remember, as we return to the Norman church, that spirit which has gone forever, that mixture of soldiery and religion which was the stamp of Crusading times. Blake must have wandered much in and out of the Temple Church, and seen in his dreams the steel-mailed Templars walk clanging across that beautiful tiled floor, and drunk in the spirit that has made England great before he wrote his lovely Jerusalem:

> Bring me my Bow of burning gold!
> Bring me my Arrows of desire!
> Bring me my Spear! O clouds, unfold!
> Bring me my Chariot of fire!
> I will not cease from Mental Fight,
> Nor shall my Sword sleep in my hand,
> Till we have built Jerusalem
> In England's green and pleasant land.

This round church of many memories is the last creation of any importance to bear the stamp of Norman work in England. Another architecture was growing whose beginnings are difficult to trace.

No one knows exactly why the term Gothic was given to the medieval architecture of Europe, for it had nothing to do with the Goths. It is said that Raphael used the words in describing this "new" architecture that had appeared north of the Alps. In his mouth the term was scornful, for the word Goth was used to denote an uncultured barbarian in contrast with a cultured Roman. Whatever its origin, the term has clung, and in the passing centuries has lost its flavor of reproach.

HOW THE SEAT OF POWER MOVED STEADILY TO THE WEST

We can understand how distasteful the new architecture was to men whose ideas were bound to the old. Prejudice against something new is one of the most enduring traits of human nature. And as Europe owed all she knew of art to Greece and the East, there was something to be said for those who denounced a strange art which was abandoning classical style.

But these men, these worshipers of the old, did not, or would not, realize that the centre of the world's life was moving steadily westward. And as the seat of power changed, architecture changed.

Greece was the home of the rectangular, columned temple. The Romans copied it. The early Christians copied work of Romans and Greeks together in an inverted way, setting rows of columns inside a severe rectangular wall, whereas the Greeks had set rows of columns outside a severe rectangular wall. Thus, as one writer says, the basilican churches were Greek temples set outside in.

Romanesque art was still derived from Greece and Rome, its chief characteristic the round-headed arch. But in the meantime the colonnade, the rows of columns that supported part of the roof, had changed to an arcade—rows of columns whence arches sprang that supported part of the roof.

THE LOFTY IDEALS OF THE BUILDERS OF THE THIRTEENTH CENTURY

So far we may trace the architecture of Europe to Greece. It was on the principle of the arch that the change came. The makers of new buildings, in that wonderful thirteenth century, were dissatisfied with what seemed to them the heavy, gloomy erections of the Romanesque type. The minds and souls of men were charged with lofty ideals, sacred aspirations and a new love of beauty. They wanted to make buildings that would fling themselves heavenward in praise and joy, and be the outward and visible sign of an inward and spiritual grace. Thus they gradually gave up the massive round shapes of Romanesque arches and began throwing up the long, pointed arches that we call Gothic.

The love of this "aspiring" form became a fever. Upon these lighter, more airy buildings, towers and spires were set. And all over Europe an amazing architecture presently rose which had nothing of the repose of the old world's buildings, but stirred with a new life.

In the temples and churches of the East windows had been almost unnecessary, because of the extreme radiance of the atmosphere. The colder and mistier light of northern countries made a certain amount of lighting imperative. The makers of the early cathedrals of Northern Europe seized this chance of a new architectural feature with all the eagerness that marked the period. Windows presently became one of the most important parts of the fabric. The different periods of Gothic work may be determined by their design.

THE FOUR GREAT FEATURES OF GOTHIC ARCHITECTURE

Thus we see three of the four characteristics of Gothic architecture: the pointed arch, the window, the tower, or spire. The fourth, the buttress, is both an interesting development of a Roman feature and an important point of Gothic construction.

The greatest problem in a large building is, as we can understand, the supporting of the roof. If it is supported in the Gothic way, by vaults that spring from arches, there is a great strain on the points of the walls where the arches press. An arch always tends to flatten itself; it thrusts out its ends against the wall or pier into which it is built. When many arches cross and combine to support a roof, the walls need very careful treating. This is part of the problem of "strains," which is very important in an architect's work. If the thrust and strain of supporting arches are not properly met, the roof, or bridge or tunnel, or whatever the arches are carrying, will fall in.

When the Romans set a weight over one of their round arches they strengthened the part of the walls whereon the ends of the arch pressed by an extra thickness. It seemed to them advisable, in their imitation of Greek styles, to use a piece of an order in this way. They made the column part of the wall, attaching it to the masonry at one side, and they gave it a heavy base. This half-column was called a pilaster, and formed a support against the thrust of the arch.

WHY THE BUTTRESS IS SO NECESSARY IN GOTHIC BUILDINGS

In Romanesque times the pilaster became, so to speak, a flat piece of wall fastened on the other wall, sloping outward, for strength's sake, at the base. Presently, so that this greater basic weight should be obtained without making an unpleasant line, the ridge of the wall was shelved in three places. From this grew the buttress of Gothic architecture. The more arches there were, the more windows (set in arches, of course), the greater necessity there was to strengthen the wall. Buttresses grew more and more important, heavier, more frequent. They ran the height of the building, working out very broadly as they descend. And as one of the rules of architecture is that a line shall end properly, they were presently surmounted by pinnacles. So we see that a constructional necessity was the cause of one of the chief features of Gothic architecture. People who have not had time to learn much about this subject are apt to think that buttresses were added, like towers, by way of ornament, and for no other reason.

In addition to the buttress, we have the "flying buttress." This was designed, not for its lovely lines, but for a hard necessity. As the centre aisles of the cathedrals were carried higher, and more and more windows set in the fabric, the arches of this highest part had to be outwardly supported by a flying buttress, which was in turn supported by the ordinary solid buttress. A wall which is nearly all windows has little strength, and, as strength must come in somewhere, the solid buttresses began to step out farther and farther, so to speak, from the building, and became like little towers in themselves. At the same time they were being narrowed so that all the available space between them should be given to windows.

THE GREAT ARTIST WHO PREFERRED THE CLASSICAL STYLE OF BUILDING

The architects of medieval cathedrals naturally became more and more engrossed in this fascinating game of playing tricks with construction. No other architecture of any period or place has produced anything approaching the sheer cleverness, apart from beauty, of Gothic work. It was, as a writer has said, like a body that carried half its bones outside, and still lived. We can quite understand Raphael, who loved the compact mass of classical architecture, with flat roofs and perfect lines, holding up his hands in horror at that architecture of Goths, yonder, north of the Alps.

The Romanesque builders had thought they were advanced men when they broke their long church or cathedral walls by a short nave, and threw out the chevet of the apse. But the Gothic architects could be even prouder of their achievement. Thousands of workmen labored on those medieval cathedrals with tool and chisel. When all the sculpture and carving was done, all the numberless little saints set smiling and happy in their niches, the tale of Christ's life told in glass in the great windows, those medieval cathedrals must have seemed too beautiful to be real. It must have appeared a fantasy, this delicately balanced mass of lovely slender stones and sweeping lines and pointing spires, held together by invisible hands.

THE THREE PERIODS OF GOTHIC ARCHITECTURE IN ENGLAND

By its very nature, Gothic architecture cannot last. It marks a period of development in the Christian Era whose pure spirit can never be recaptured. So that the love we have for medieval buildings is the love of something which may easily be lost, and, once lost, is lost forever.

For three hundred wonderful years cathedrals in France, Germany and England were built in this style, which in itself was constantly changing or developing. In England Gothic architecture is divided roughly into three periods—that of the thirteenth century, called Early English; that of the fourteenth, called Decorated; that of the fifteenth, called Perpendicular. In a great many English buildings these three styles meet, as one century made additions to the work of the century that went before it.

English Gothic architecture is marked by a sobriety and a strength that does not often appear in French Gothic. A Gothic building, to be imposing, must excel in either length or height. The French attained a greater height, and the English a greater length. Although the work was executed on the same principles, the effect of national character came out; so that in time English Gothic became a distinctive architecture of its own.

In time, we say, for at the beginning of Gothic work there was very little difference. England and Normandy were still, practically speaking, one province, divided only by the Channel, and workmen still came and went as from one end of a kingdom to another. One of the most interesting cases of this interchange of labor was that of William of Sens—a little town south of Paris—being summoned to Canterbury in about 1170 to rebuild the cathedral on the lines of that he had just set up in Sens. The French William built the choir and William the Englishman continued the work.

THE DOMINATING FEATURE OF THE EARLY ENGLISH GOTHIC

Early English Gothic was simple, of fine proportions, with lancet-shaped windows which were long and narrow, pointed at the head. This particular shape could be seen not only in the windows, but in the whole structure; arches, doorways, the lines of the roof vaulting, the clerestory and blindstory, all conformed to this delicate and beautiful shape. When we go to London we can see what Early English Gothic was in the choir and lady chapel of Southwark Cathedral (the nave has been restored), the chancel of the Temple Church, the chapel and crypt of Lambeth Palace, and certain parts of Westminster Abbey.

A great many of the provincial cathedrals happily retain something of the Early English spirit. We can find it in the transepts of York Minster, the nave and chapter house of Lincoln Cathedral, the choir and transepts of Rochester Cathedral, the nave, transepts and west front of Wells Cathedral, the choir, transepts and the "Galilee Porch" of Ely Cathedral, and in parts of Southwell Minster, Worcester Cathedral, Beverley Minster, Glasgow Cathedral, Elgin Cathedral.

THE THREE SPIRES THAT TOWER ABOVE THE RIVER AT LICHFIELD

The finest and most complete evidence of what Early English Gothic was is shown at Salisbury and Lincoln.

The little cathedral of Lichfield—one of the smallest in England—also has a peculiar interest as we study this period. The main part is Early English, with an unusually fine west front. Lichfield is the only cathedral in England possessing three spires (added in the fourteenth century), two at the west front and one at the crossing of the nave and transepts. These three graceful points are known as the "Ladies of the Vale."

The simple spire, without any parapet, surmounting a short tower at the crossing was a feature of Early English Gothic. In the later period towers became heavier, and sometimes stood alone, and sometimes were surmounted by spires. The French architects threw up their cathedrals to such an immense height that the structures could not support a heavy tower at the crossing. The central tower remains an English feature of Gothic architecture.

The most beautiful spire in England is that of Salisbury Cathedral. This building is one of England's most precious possessions, a piece of the best Early English Gothic imaginable. Almost all the cathedral as it stands was built during the years 1220 to 1258. The spire, 404 feet high, the loftiest in the country, was added a hundred years later.

THE CATHEDRAL WITH A WINDOW FOR EVERY DAY IN THE YEAR

There is often a rambling look about Gothic cathedrals, as if they grew, rather than were planned. This is absent in Salisbury Cathedral. It is beautifully proportional and held together, line falling upon line, the spire rising triumphantly from their midst. By accident, or curious design, the cathedral is said to contain as many windows as there are days in the year, as many pillars as there are hours, as many doors as there are months.

The interior as well as the exterior is stamped with Old English history. Here are monuments to some of the early bishops and to a great many nobles—some of artistic interest, others memorable because of the dead. Richard Jefferies and Henry Fawcett, the blind Member of Parliament, have memorials here.

Lincoln Cathedral tells us another beautiful tale of old English genius. It rises on a hill above the town, washed by the clear East Country air, throwing bravely up its middle tower as if proud that it is the highest central church tower in England. The measurement of this tower is 271 feet high. Very soon Lincoln will have to take second place in this matter, as the tower planned for the new Liverpool Cathedral by Mr. Gilbert Scott is 280 feet in height.

The earliest parts of Lincoln Cathedral, the choir and eastern transepts, were erected in about 1190 by an English architect, a Lincolnshire man. The building went on for over a hundred years, and at the end of that time, in about 1314, the "Angel Choir"—more in the Decorated style than the Early English—was built. The general plan is something like that of Canterbury, but the treatment, the solidity, the gravity are very English, hence the phrase, "National Lincoln."

THE DECORATED SCREEN WALL ON THE FRONT OF LINCOLN CATHEDRAL

The west front of Lincoln Cathedral is of great interest, apart from the lovely work, in that it is a kind of decorated screen wall, and behind it rise the western towers. The screen wall is broken by very beautiful doorways, but this hardly makes up for the way the towers seem to be cut in half and have no base.

These towers, spires and decorations at the western end of Gothic cathedrals grew out of the architects' desire to end the building so as to hide the abrupt finish of the roofs of nave and aisles. If we look at our pictures of various cathedrals, we shall see what a wonderful development this is, always remembering that one of the chief points in architectural design is that line shall be properly stopped—the line in this case being the long length of the cathedral roof.

One of the most wonderful western fronts in Early English Gothic is that of Peterborough Cathedral. Here three immense arches run up the entire height of the building, with a gable on each arch, giving a grandeur and simplicity of line that has no equal. The façade is said to be the finest west front in the world. In this fine cathedral is united most memorable work both of Norman and early Gothic period. Unfortunately, for all their solid, heavy masonry, the Norman builders made poor foundations. If Peterborough Cathedral had not been skillfully underpinned it would have been in ruin before our day.

THE WONDERFUL LANCET-SHAPED WINDOWS OF YORK MINSTER

Another trace of the genius of Early English Gothic is shown in the famous transepts of York Minster. Here, in the northern transept, are The Five Sisters—five immensely long, lancet-shaped windows, side by side, fifty feet high and five feet wide. Some of the finest stained glass in England, made in the fourteenth century, is in this cathedral.

To the fourteenth century belong the west front and nave of York Minster, and here we can see the difference between the Early English and Decorated Gothic. The windows have become larger, and instead of being simple, lancet-shaped lights, are marked by elaborate stone traceries, which act like settings to the jewels of the colored glass. This rich splendor and ornateness, spreading to all details of architecture in stone and wood alike, was the chief note of the Decorated period.

During this time a good many towers were set up on various cathedrals, and the "fancy" spire, rising from a tower base, sometimes many-sided, with parapets and lights and pinnacles appeared. Very fine chapter houses were built. Clerestories, set high in the walls, became more important, and blindstories less important.

It is interesting to note, in passing, that Bristol Cathedral has neither clerestories nor blindstories, the aisles being carried up almost the height of the nave. This cathedral, like those of Bangor, Llandaff, Ripon, St. Albans, Southwark, has been variously restored and added to.

THE FINE CHURCHES THAT WERE LOST IN THE FIRE OF LONDON

The interiors of decorated Gothic buildings were marked by very elaborate roof vaulting, the ribs, or surface ridges, of the vaults making all kinds of geometric designs. To this period belongs the star-shaped vaulting, where the ribs cross each other to make a star.

A fine specimen of Decorated Gothic architecture can be seen in the Chapel of St. Etheldreda, in Ely Place, Holborn, originally the chapel of the Bishop of Ely's palace. Both east and west windows are excellent examples of the work of this period. The Church of the Austin Friars, and St. Helen's, Bishopsgate, also bear the stamp of the fourteenth century. To these years belong the east cloisters of Westminster Abbey.

The builders of this period, which roughly covers the fourteenth century, were employed in many ways in England, adding a chapel or a transept here and a tower there. There was no great line between Early English and Decorated Gothic. Many churches were built which are lost to us through the Great Fire of London in 1666.

The Decorated period touched its height in certain parts of Exeter Cathedral, and the Lady Chapel, Ely. The carved work in stone and wood of Exeter Cathedral is among the finest in England. A great breadth and a wealth of stone tracery mark the windows; details like the minstrels' gallery are especially beautiful. One unique feature at Exeter is the carrying-up of the north and south transepts into twin towers. It is interesting to note that in this cathedral is the heaviest peal of ringing bells in the world.

The genius of this wonderful fourteenth century in England did not restrict itself to the mere fabric of the building. Cathedrals and churches were frames, so to speak, wherein was set most lavish craft-work of all descriptions in wood and metal. The stoneworkers, woodcarvers and brass- and iron-workers shared each other's zeal. When we think of the chancel screens or rood screens, the grilles, choir stalls, lecterns, bishops' "thrones," fonts, the most beautiful mellow glass that filled the richly traceried windows, the lovely illuminated psalters and missals that were used, we only think of details of that grandeur which the fourteenth century produced.

THE LOVELY LITTLE CHAPELS IN THE GREAT CATHEDRALS

During these generations most lovely tombs and monuments and shrines were set in the cathedrals. The story of these alone would make an entrancing book. Each in its way was as interesting as the Crusaders' monuments in the Temple Church; the mass of them show very great art. Lovely little chantry chapels were set, generally in the bay of a cathedral aisle, screened from public view by magnificent carving and ironwork. Here, in the days before the Reformation, masses were said for the souls of the dead.

Piety and a love of beauty lay in the founding of these chantries, built by people rich enough to maintain them. As we think of them we remember the night-watch of Henry V before Agincourt:

> I Richard's body have interred anew,
> And on it have bestowed more contrite tears
> Than from it issued forcèd drops of blood . . .
> and I have built
> Two chantries where the sad and solemn priests
> Sing still for Richard's soul.

The Reformation and rebellion of the Puritans were the cause of the destruction of many of these fourteenth-century works of art. We can only be thankful that some are left, like that of Henry V himself in Westminster Abbey, Prince Arthur's Chantry in Worcester Cathedral, the Ramryge Chantry Chapel and St. Alban's shrine in the cathedral of St. Albans, the shrine of St. Thomas de Cantelupe in Hereford Cathedral, the tomb of Bishop Bridport in Salisbury Cathedral, the Percy Chapel in Beverley Minster.

THE CROSSES ON THE WAYSIDE FROM NOTTINGHAMSHIRE TO LONDON

A little of the romance of medieval England exists for us in the ruins of the Eleanor Crosses, set up at the order of Edward I in memory of his beloved queen, Eleanor of Castile, who died at Harby in Nottinghamshire in 1290. The body was conveyed for burial in solemn procession, by slow stages, from Nottinghamshire to Westminster Abbey. Afterward a cross was erected in each of the twelve places where the body reposed at the nightly halts.

The restoration of the cross at Waltham, near London, said to be finest of all, gives some idea of the richness of these memorials. One was erected at the village of Charing, the last halt before Westminster, hence the name, Charing Cross. It was taken down in the troubled seventeenth century, but a modern memorial in the station yard marks its site.

As the fourteenth century died away a slow change passed over architecture, and with the next hundred years came the end of Gothic in the Perpendicular style. This, as its name suggests, was a fashion of Gothic wherein the lines were drawn out long and pointed. It may be noted chiefly in the upright lines of the window, and the pointed panel shapes that decorated walls, outside and in, in every available space, even on the buttresses.

Buildings were thrown to a great height, windows became enormous. Fan vaulting was the chief characteristic in the very elaborate roof work of the period. Its finest example is in Henry VII's Chapel at Westminster, which is the best piece of architecture produced in fifteenth-century England.

The Church of St. Margaret, Westminster, was built in this style and also the Savoy Chapel, Westminster Hall, the porch of the Guildhall, St. Olave's Church, Hart Street, near the Tower, and St. George's Chapel, Windsor.

The Perpendicular period left its stamp on cathedrals like Winchester, Gloucester, Beverley and Sherborne minsters, Canterbury, Chester, the Beauchamp Chapel, Warwick. Manchester Cathedral was built during this time.

THE END OF THE GOTHIC SPIRIT IN ARCHITECTURE

No architecture to equal in importance that of the thirteenth or fourteenth century marked these generations. The Gothic spirit had spent itself. Constructionally, the work was becoming weaker, walls more and more like a patchwork of glass supported outwardly by enormous buttresses. Nothing more could be developed from the style. Early in the sixteenth century it died out.

In Westminster Abbey, more than any other cathedral, the various styles of Gothic met. This great building has an especial place in the hearts of English-speaking peoples, for its roots and its associations lie deep in their history. At the hands of the early kings, from the Confessor onward, it passed through many stages and received the impress of the various styles.

The church which is now called Westminster Abbey was originally part of a great group of buildings, monastery and royal palace, the palace making way for the Houses of Parliament. The monastery was one of the largest Benedictine institutions in Europe, and round it presently gathered ordinary dwelling-houses, like a village scattered about the monastery's feet. From this settlement grew the city of Westminster, an isolated town standing in the greenery and marshes of the Thames.

The monastery comprised the usual set of buildings—Abbey church, cloisters, refectory, dormitory, chapter house, mills, workshops, orchards. Its trout stream still flows, running under Great College Street to join the Thames. The monks' common court is now Dean's Yard. There was also an inner court which still exists as Little Dean's Yard. The abbot's house is now the Deanery, and this, with Jerusalem chamber and the dining-hall was rebuilt in the fourteenth century. Parts of the Confessor's Norman work still exist—the chapel of the Pyx, and the undercroft close by.

To Henry III belong the honors of rebuilding very nobly a good part of the Abbey church, which, in general plan, resembles the Cathedral of Rheims. It is 511 feet long, and the nave has the highest Gothic vault in England. Henry moved the famous shrine of the Abbey's founder, Edward the Confessor, to its place in the chapel immediately behind the high altar, where the Coronation chair also stands.

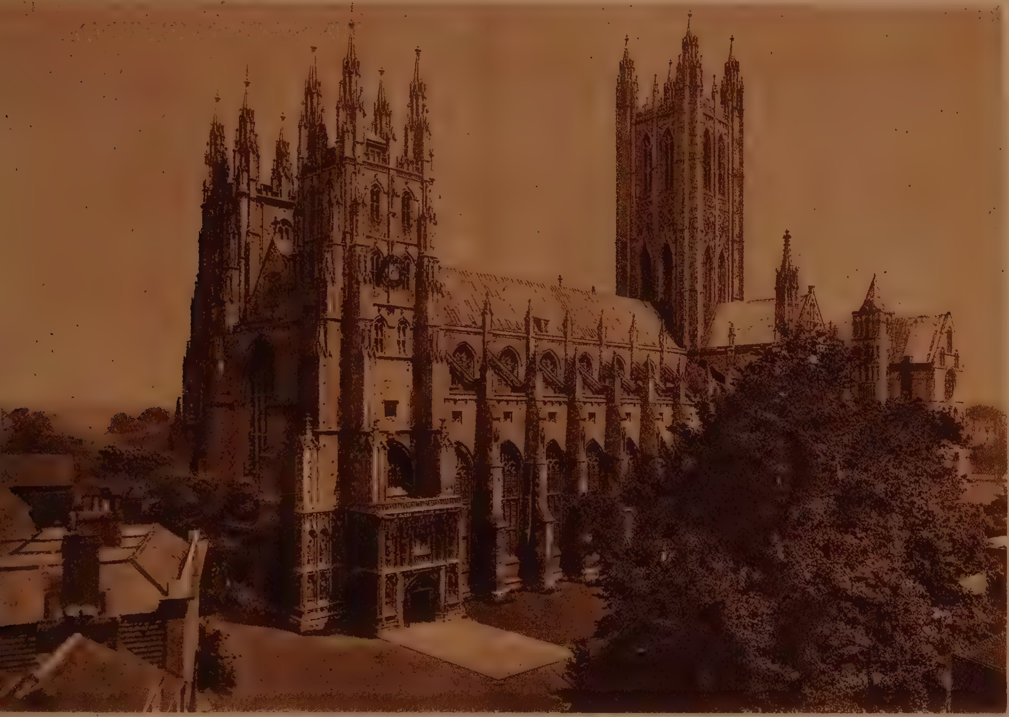
For some seven hundred years this has been the greatest, the most venerated tomb in England. Sick people were brought there to be cured, and places were arranged at the side of the shrine where they might be placed. The monument of Purbeck marble was defaced at the Reformation; its richly jeweled decorations destroyed. Later, in the reign of Mary Tudor, a fine canopy carved in wood was set over the tomb. During the World War this superstructure was removed for safety's sake, and afterward restored.

THE NOBLE BUILDING WHICH BREATHES THE HISTORY OF ENGLAND

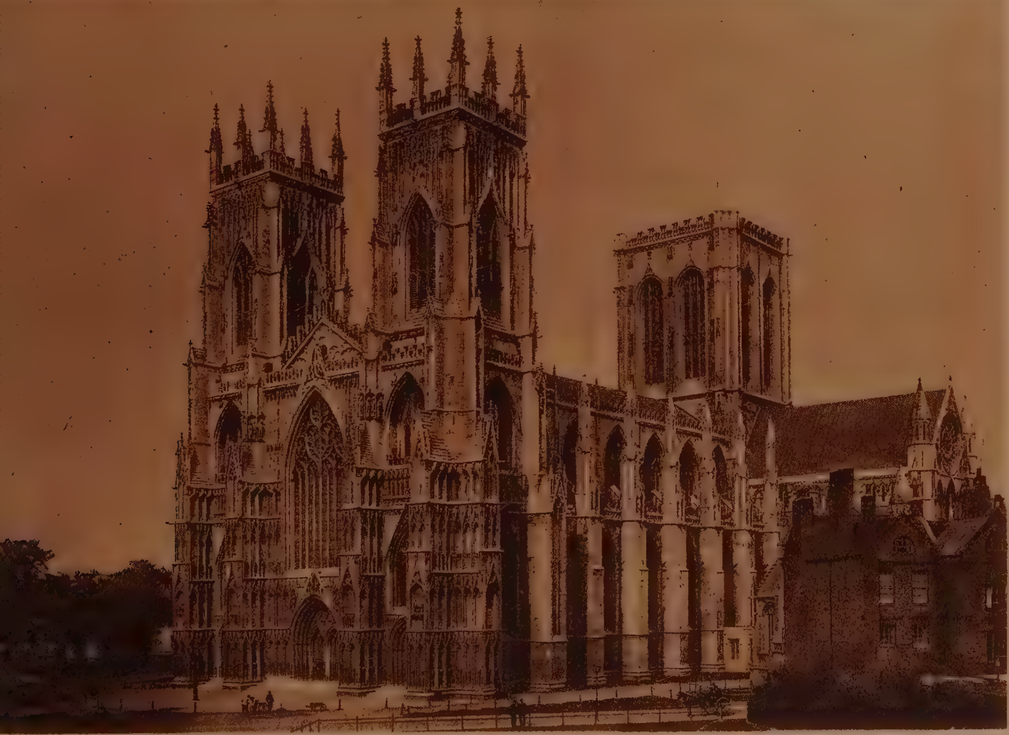
In the Confessor's Chapel five kings and six queens are buried. And in the various chapels that group themselves about the apse, forming the chevet we have mentioned earlier, stand a great many very famous tombs and shrines, foremost among them Henry V's chantry, the tomb of Henry III and his wife Elizabeth of York, the tomb of Edward III. Apart from the memory of the people immortalized, these tombs and monuments are examples of the art which was so rich in England during the Gothic period.

Such is the power of history in the Abbey, that we are likely to forget even the wonderful building. If we are students of architecture we shall go from door to door, from transept to transept, from nave to aisles, from chapter house to cloisters, tracing a century here and a generation there, in pillar and arch, vault and buttress.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6155.

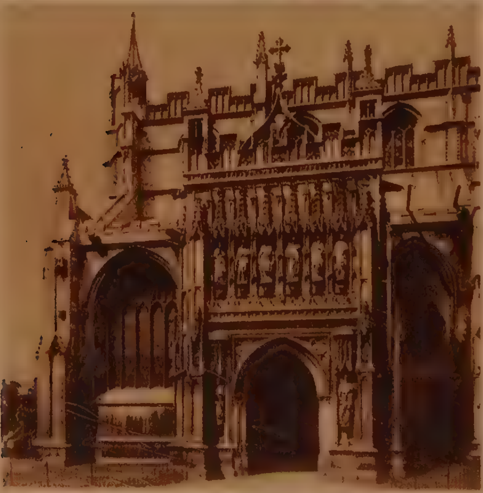


CANTERBURY CATHEDRAL SEEN FROM THE SOUTHWEST



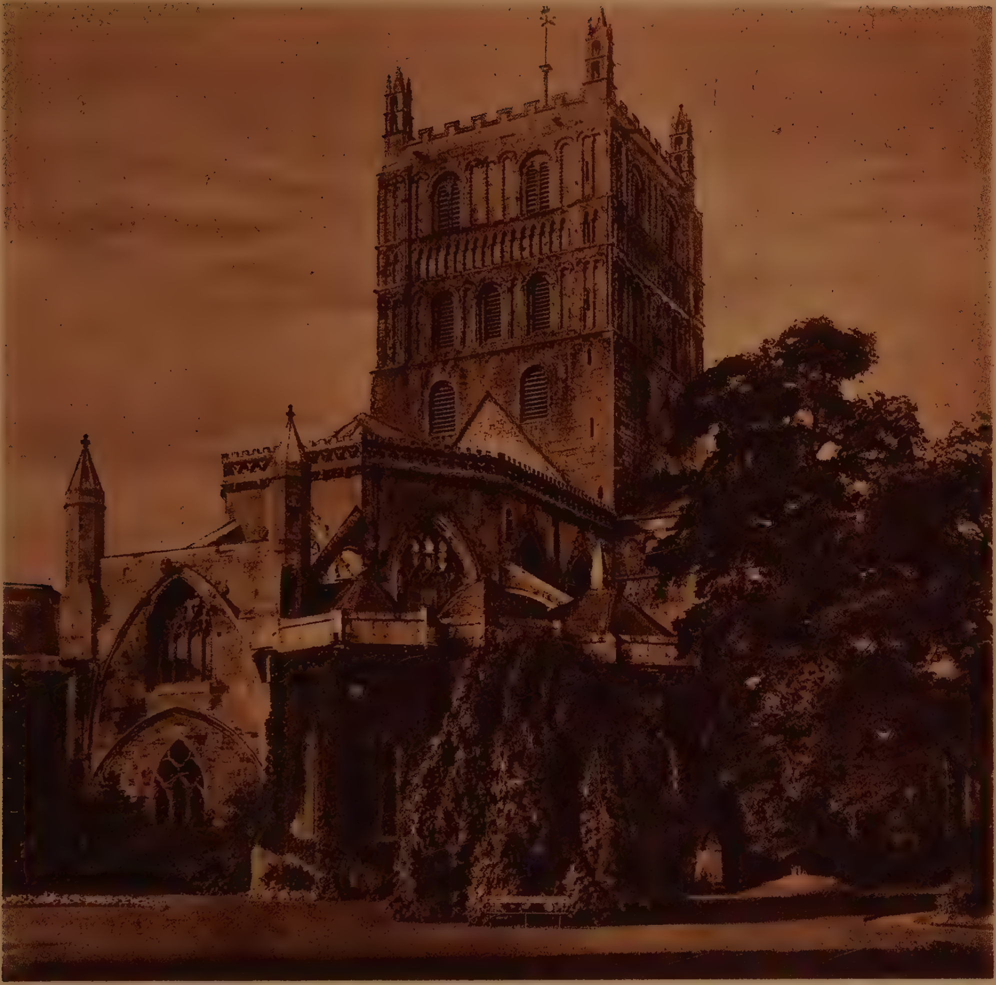
THE WEST FRONT OF YORK MINSTER, A BEAUTIFUL EXAMPLE OF THE PERPENDICULAR STYLE

HEREFORD CATHEDRAL AS SEEN FROM THE SOUTHEAST

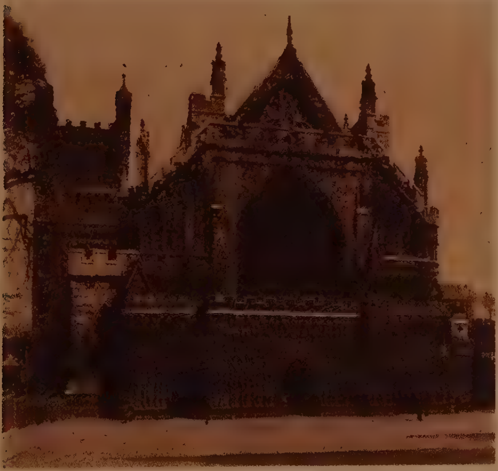


THE SOUTH PORCH OF GLOUCESTER CATHEDRAL

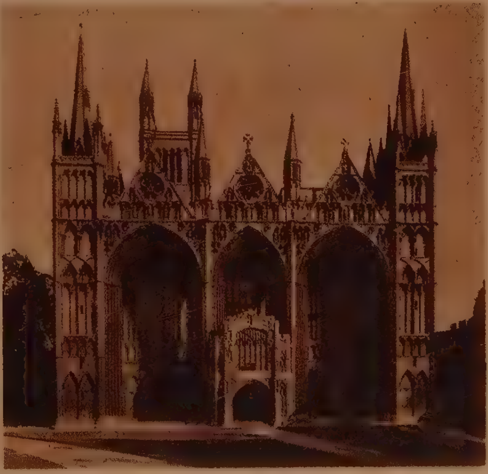
ROCHESTER CATHEDRAL BEFORE ITS RESTORATION



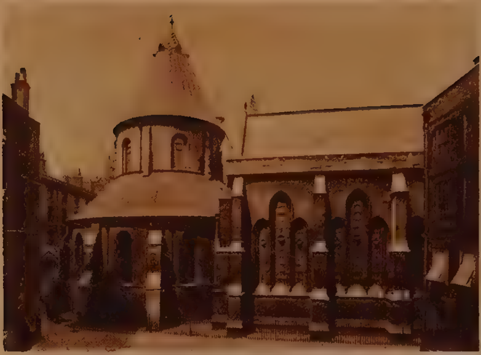
TEWKESBURY ABBEY AS SEEN FROM THE NORTHEAST



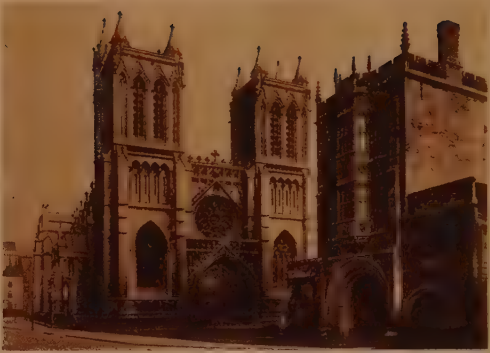
THE WEST FRONT OF EXETER CATHEDRAL



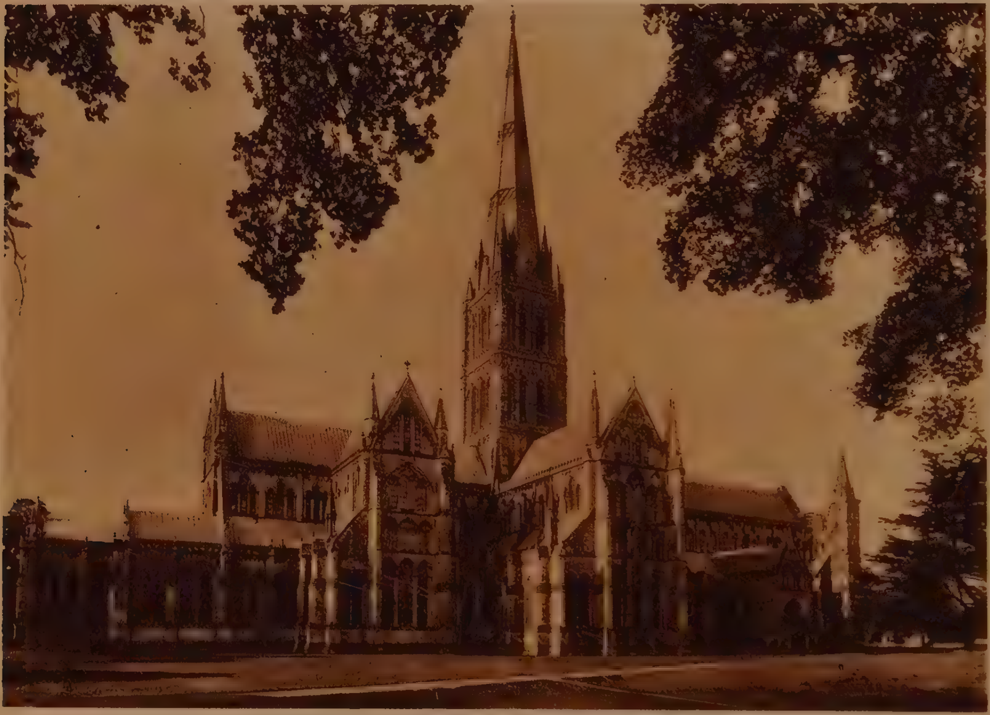
THE WEST FRONT OF PETERBOROUGH CATHEDRAL



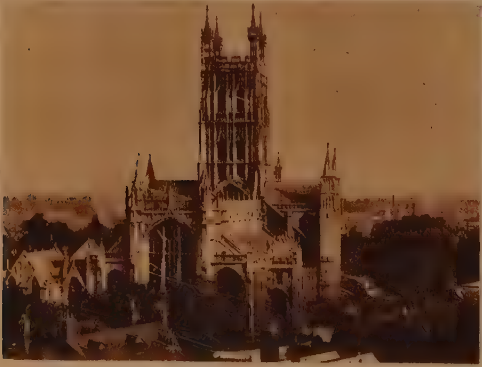
THE TEMPLE CHURCH IN LONDON



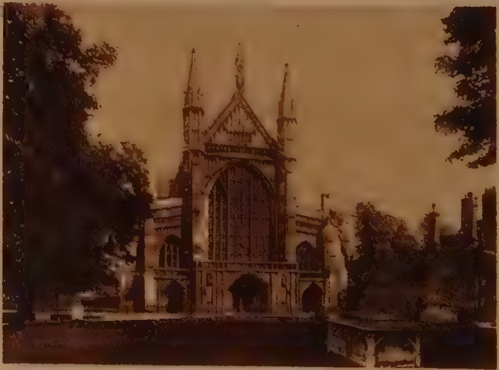
THE WEST FRONT OF BRISTOL CATHEDRAL



SALISBURY CATHEDRAL, WITH ITS FAMOUS SPIRE



GLOUCESTER CATHEDRAL



THE WEST FRONT OF WINCHESTER CATHEDRAL

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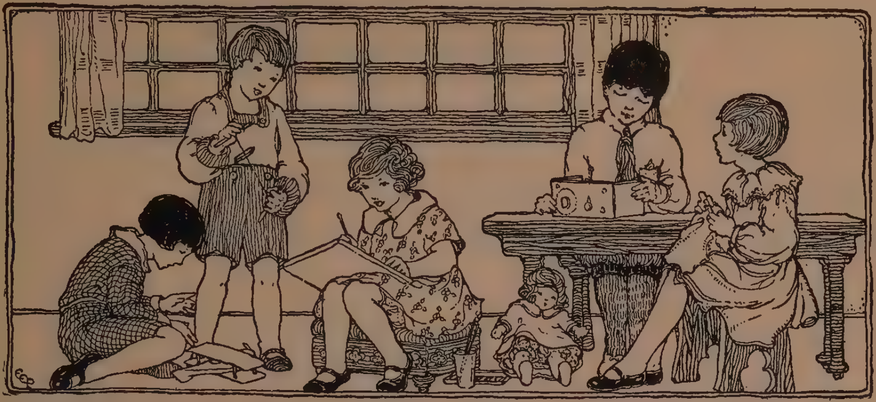


ENJOY YOUR RADIO ON AUTO TRIPS

MANY boys and their fathers dislike to give up their fun with radio receiving sets during vacation automobile trips. Of course you do not need to be deprived of this pleasure if you will plan to take this important part of your vacation equipment with you.

The most difficult problem in auto-radio is the small space available for an aerial. A set that ordinarily works well on a coil aerial, as many three-tube to five-tube sets do, can easily be installed on one of the little seats that let down from the back of the driver's seat or pull up from the floor. The loop can be hung from the top of the car, guyed with twine, and changed at will to secure desired directional effects.

A greater spread of wire, and consequently more energy, can be obtained by erecting short masts on front and rear bumpers, or at other convenient points at the ends of the car, and stringing an antenna between them. Copper wire of good size is preferable, but the weight of the wire must not be more than the masts can stand. An aerial of fair efficiency can be made by running wire back and forth on the under side of the top. The neatest way is to have it placed between the outer and the inner fabrics, but even though it is in sight it need not be ugly, for appropriate colors can be chosen and it can be attached with thread to match. Any aerial that is in contact with the top or any other object except an insulator should be of insulated wire.

The ground wire from the set is usually attached to the engine. This is not an actual ground connection, but the engine serves as a counterpoise and the effect is similar. Any set installed in a car must be protected by springs or cushions from jolting that might be fatal to the tube filaments, which break more easily when hot than when cold. A light set may be hung from the ribs of the top, with coil springs attached to the cords or wires that support it so that shocks will be absorbed. Guys to the foot-rest will prevent too much swinging.

A ½-inch board of pine or cedar, about 3 inches wider and 2 inches longer than the baseboard of the radio set, is light, strong and well adapted for use as a swinging shelf. The supporting cords or wires can be put through holes in the four corners, or four strap-hinges from 2 to 4 inches long can be screwed to the under side at the corners and the cords or wires attached in the unoccupied screw-holes. Such a shelf can be stained to match the inside of the car, and cords or wires can be selected for decorative effect as well as utility. Hooks on the shelf can engage screw-eyes on the cabinet of the set, or vice versa, so that there will be no danger of the set sliding off.

Somebody may object that the family radio receiver should not be subjected to the hazards of auto travel. In that case, $25 will purchase the materials of a set that can be erected on the shelf. Most amateur constructors have enough so-called junk about to make a receiver. Amplifying units, either for radio-frequency or audio-frequency or both, can be added on the same shelf without making it long enough to be unwieldy.

If a set is to be constructed especially for the auto, its possibilities can be increased by running short wires from the apparatus down through holes in the shelf to binding-posts or clips attached to the bottom. Then, with a dozen wires of convenient length for connections, any hook-up possible with the apparatus used can be made in a few moments. Changes in circuits can be made almost as fast as the auto changes its location. A set on a swinging shelf can be used in the house as well as in a car, though through force of habit we usually place our sets on tables, making it difficult to get at certain parts of the "works," instead of hanging them up where every part is easily reached.

There are several objections to installing radio sets on the dashboards of automobiles. The driver, minding gas, spark, road, brake, gear shift, speedometer, dogs, pedestrians, other cars and the traffic cop, has little time to tune or listen. A receiver on the dashboard is too close to the magneto and spark plugs, which are likely to cause noises. The place for the radio set in an automobile is near the rear seat if there is one. If the car has but one seat, then the set may hang from the top just in front of the person at the right. In this case it should be easily removable, with antenna and ground connections through plugs or clips that can be adjusted or disconnected in a moment.

The batteries used for starting, lighting and ignition in a car can be used to light the filaments of the tubes in a radio set. It is necessary to know what voltage and amperage the tube requires and adapt the battery current to it by using the proper resistance. Separate batteries for the radio set are desirable if it is to be used while the car is running, for the changes in current produced by the changing demands upon the battery are very noticeable in a device as sensitive as a radio receiver. Disk types of loud-speakers can be used in automobiles more easily than horns. For protection they can be inclosed in frames or crates.

The radio set in an automobile, however much pleasure and profit it may have yielded in the moving car, will give still more joy when a halt is made for lunch, for tests or for the night. A plumb bob on the end of a chalk-line will serve to get your one-wire aerial over a conveniently high tree limb. The receiver remains in the car or is carried to any spot where it is wanted. A ground wire is attached to a long iron spike driven into the ground or tossed into the creek.

Although you may be many miles away from home, with your radio set as a companion on the vacation automobile trip you may secure all of the advantages by this means of entertainment that await you at home. On long trips this is especially appreciated.

SIMPLE TRICKS FOR ODD MOMENTS

THERE are many simple tricks that may be performed with little or no apparatus that cause a great deal of fun and amusement at any gathering of our friends.

For instance, we announce that we can place a glass of water upon the table, cover it with a hat, and then drink the water without removing the hat. This sounds an impossible task, and everyone is anxious to see the trick performed.

It is done in this way. We stand a glass of water on any ordinary table, borrow a hat and place it over the glass. While doing this we talk and emphasize the wonder of the trick we propose to show our audience, and we say that on no account must anyone touch the hat.

Then we go under the table and make a pretense of drinking the water through the wooden table. Everyone is, of course, skeptical, and, after coming from under the table, we ask one of the audience to remove the hat to see if the water has been drunk or not. As soon as this is done we seize the glass and drink the water, and then announce to our surprised audience that we have done what we promised to do—namely, to drink the water without removing the hat, someone else having removed the hat for us.

Another simple trick is to take two pennies from our pocket, and then ask if anyone in the audience will lend us one penny. Of course someone immediately does so, and we now have three pennies. Placing them down on the table one after the other, and counting them as we do so, we say:

"One, two, three—that makes four pennies."

"No, three pennies," says the one who loaned the penny.

"One, two, three—that makes four pennies," we repeat as we count out the three pennies again, and regard our friend with a surprised look.

Our friend insists once again that we have three pennies only, and then we exclaim:

"Well, may I keep the penny if I am wrong?"

In nine cases out of ten the answer that will be given will undoubtedly be Yes.

"Well, I *am* wrong, so I keep the penny," we reply, and our friend then realizes that he has been tricked, while the audience laughs heartily. We should practice this before trying it at a party, for the success of the trick depends upon there being no hesitation in the counting.

There is another simple trick, which usually mystifies an audience and creates much interest. We undertake to pick a marked penny out of a hat without seeing it. First of all we borrow a hat, and then ask three or four members of the audience to put a penny each into the hat. We next cover this with a handkerchief, and talk for a minute or two to allow the coins to become perfectly cool.

Now we ask any member of the audience to take one of the coins from the hat and put a mark upon it, after which he is to return it to the hat and cover the whole with the handkerchief again.

Then comes the climax of the trick. Approaching the hat without looking at it, we talk of the wonders of magnetism and, putting our hand under the handkerchief into the hat, extract the marked coin, to the astonishment of all beholders.

The explanation is as follows: In marking the penny the member of the audience handled it for some few seconds, and the heat of his hand was communicated to the penny. When we feel the coins in the hat, the warmth of the one that has been handled is quite perceptible, and we are able to identify and to bring it triumphantly from the hat.

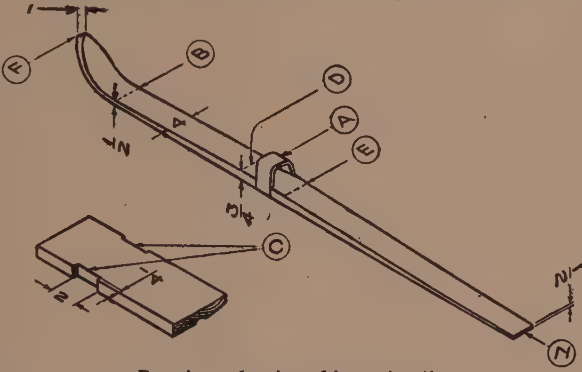
To be still more certain that the penny selected and marked shall be warm, we can ask the one who marked it to hand it round among the other members of the audience, so that they may all examine it thoroughly and be able to recognize it again when they see it. This adds to the importance of the trick and creates greater interest, besides insuring success.

Simple tricks like this that cost nothing at all for apparatus, and that require very little skill to perform, often give the greatest amount of pleasure to those who see them.

HOW TO MAKE YOUR OWN SKI

OF the various out-of-door sports skiing has become increasingly popular during the past few years. Although ski may be bought for a few dollars, many boys prefer to have the fun of making their own at little cost.

Such ski are usually made between 4 and 9 feet long, the exact length depending, of course, upon the weight of the wearer. A boy weighing approximately 100 pounds should have ski about 5 feet in length, while one weighing 120 pounds should have them about 6 or 7 feet long. The width of the ski should be determined by that of the sole of the shoe. The space between the insides of the toe-strap *A* should be approximately the same as the widest part of the sole of the shoe. Perhaps the best ski are made of straight-grained ash or spruce, but pine, cypress, or almost any other wood which is not too heavy for this purpose may be used if neither ash nor spruce is available. Oak can be used, but is harder wood and more difficult to work with.



Drawings showing ski construction.

To make ski, first plane two pieces of the stock selected to the required width and length. Then draw a line, *D*, across the face of each piece 6 inches from the centre line, *E*. Across the end *N* draw a line ⅝ inch from the face side. Along the edges draw lines connecting the ends of line *N* with the ends of line *E*. Plane the face side down to these lines, leaving the face level and square with edges. Twelve inches from the opposite end draw a line, *B*, across the face of the ski. From the ends of line *B* square lines across the edges. From points upon these lines, halfway between the edges, draw lines to the end of line *D* and to the face of the ski at the end *F*. Plane the face of the ski to these lines.

Now scrape and sandpaper surface as smooth as possible. It will be found advisable to "raise the grain" of the wood by soaking it in water and sanding down the roughened surface until smooth again. Then repeat this process until the added moisture has no effect upon the wood. The ski should have sharp-edged, semicircular grooves in their lower surfaces, about halfway between and parallel to the long edges. These are intended to serve the same purpose as hollow grinding the blades of your ice skates. These ski are usually finished upon the top and edges with Valspar or any bright-colored paint. The lower surfaces are then filled with tallow, which is rubbed in while it is still hot. Before the finishing material is applied the pointed ends are turned up by holding them over steam from a kettle.

While expert jumpers always fasten the ski to their feet by means of an elaborate "harness" of straps and buckles, amateurs ordinarily use only a strap about 2 inches wide which is set into the edges of the ski and is made just long enough to permit the foot to be easily slipped in and out. Although this strap may be of leather, a thin piece of rubber belting is more satisfactory, as it is not affected by the moisture.

SOLUTION OF THE GUARD'S PUZZLE

ON page 5892 is given the puzzle of how the guard at the king's hunting-lodge was able to arrange its numbers every night so that there were always 9 soldiers on each side of the king's chamber. On the first night, when 4 soldiers went to the village, leaving only 20 behind, these disposed themselves as in the first diagram. On the second night, when 4 friends of the troopers came to the lodge, and there were thus 28 instead of 24 men present, they were distributed as in the second diagram. The third night 8 visitors entered the lodge, and these, with the 24 soldiers made a total of 32 men to be arranged, so that 9, and only 9, should appear on each side of the house. They did so in the manner shown in the third diagram. On the fourth night, when 12 friends visited the lodge, the men distributed themselves as in the fourth diagram. Finally, on the fifth night, when 6 of the soldiers went to the village, leaving only 18 of their number behind, these 18 arranged themselves as shown in the fifth diagram. It will be seen that in every case, no matter whether there were fewer or more than their correct number present, they were always able to arrange their guard so that the king's order to have 9 men on each side of his chamber was obeyed.

4	1	4
1		1
4	1	4

2	5	2
5		5
2	5	2

1	7	1
7		7
1	7	1

	9	
9		9
	9	

5		4
4		5

WHAT TO DO IN MANY KINDS OF ACCIDENTS

A SEVENTH LESSON IN FIRST AID TO THE INJURED

CONTINUED FROM 5600

THERE are many kinds of accidents in which it is important that efficient aid should be rendered instantly.

Among such accidents are burns and scalds. Scalds are caused by moist heat, and the most common cause is steam or boiling water, though other liquids, such as hot oil, may also cause severe scalds. Burns, on the other hand, are the result of dry heat, and may be caused by fire itself; by hot iron; by friction, as when we touch a quickly revolving wheel; by acids, such as oil of vitriol; or by alkalies, such as quicklime, coming in contact with the skin.

The first thing to do in case of an accident of this kind is to remove all the clothing which is near the wound. If it adheres to the wound, then it must be cut away carefully all round, but on no account must we pull away anything that is sticking to the flesh. We should saturate the adhering pieces with the oil, if oil is available, so that later on they may come away.

DRESSING BURNS AND SCALDS

The great necessity in cases of burns and scalds is to get the wound covered up quickly, so that it may not be exposed to the air. This is of supreme importance, and while one person is cutting away the clothing others should, if possible, prepare dressings to put over the wound. Pieces of gauze or linen should be saturated with oil, or smeared thickly with vaseline or cold cream, and laid upon the wound at once. Then cotton or flannel should be placed over these dressings and bandaged lightly. When the wound is very large we shall find that it is easiest to put on the oiled lint or linen in strips, not in one large piece.

Should no oil or ointment be available, we should shake thickly over the wound fullers' earth, or powdered whiting, or flour, or starch powder, seeing, of course, that the powder is quite clean. If even these cannot be obtained quickly, the inside of a raw potato may be scraped fine and applied upon the gauze or linen.

If there is any delay in getting the necessary materials for dressings, the injured part should, when possible, be placed in water at the same temperature as the body, that is about 98° Fahrenheit. The treatment is the same no matter what part of the body may be injured in this way, but if it is the face, we shall find it an excellent plan to cut out of the gauze or linen a kind of mask with holes for the eyes, nose and mouth, and then to oil this mask and put it on the injured part.

Having dressed the wound, we treat the patient for shock. We lay him on his back, with his head lower than his feet, and see that he has plenty of fresh air freely circulating round him. If the accident has happened in the street, the crowd must be kept back. Smelling-salts should be held to the nose, and, if possible, a dose of sal volatile and water given. The patient must be kept warm. Cover him up well, put a hot-water bottle to the feet if possible, and give some hot drink, such as warm milk or coffee, adding plenty of sugar, as sugar increases the temperature of the body.

BURNS CAUSED BY ACIDS

The treatment that has been described is for all kinds of burns and scalds. But in the case of burns caused by acids and alkalies, before applying the oiled bandage, something else has to be done first. If the burn has been caused by an alkali, such as quicklime or ammonia, we first of all bathe the part with a weak acid, such as vinegar and water mixed in equal quantities, or lemon-juice and water similarly mixed. On the other hand, if the wound was caused by an acid, then we bathe with a weak alkaline solution, such as washing-soda, magnesia or bicarbonate of soda mixed with warm water. Then after bathing in this way we can apply the dressings as already described.

If anyone sets fire to his or her clothing, the person should be at once laid flat on the ground with the burning part uppermost, and then the flames should be smothered with a rug, tablecloth, mat, blanket, sack or any similar large cloth. If this can be made wet without any delay, it will, of course, put out the fire most effectively. A girl helping to put out the flames of another's clothing should hold a rug or mat in front to protect herself. If we catch fire ourselves when no one is near, we should at once lie flat upon the ground, with the flames uppermost, and smother them with anything that is handy. We should on no account run about, especially in the open air.

FROSTBITE

At the opposite extreme from a burn or scald is a frostbite. The intense cold stops the circulation of the blood, the part affected becomes red, then white, and then purple, and a numbness sets in. The best remedy for frostbite is to use cold applications. Plunge the frozen part into very cold water, or rub with crushed ice for several minutes. Then gently massage with warm hands. The object is to let the blood flow slowly into the tissues and prevent the parts from becoming gangrenous. The patient should on no account be brought before a fire or into a very warm room until the circulation has been restored by continued rubbing of the frostbitten part. If snow is available, the part should be rubbed with snow. When the circulation of the blood is restored, the frostbitten part should be wrapped in cotton and warm food given to the patient, who should be kept in a cool room.

SHOCK

In learning earlier in this lesson what to do in cases of burns and scalds, we also saw how we should treat a patient for shock. This is the treatment generally given for any kind of shock and also for fainting. The cause of the shock of fainting must, of course, be removed.

For instance, if it is due to loss of blood, the bleeding must be stopped in the proper way; if it is due to lack of food, nourishment must be given, but this must be done very carefully and very slowly at first. If the breathing cannot be noticed, then respiration must be restored as in cases of drowning, which we shall learn later.

STINGS AND BITES

In the country people are often stung by bees and wasps, and we may try to do something to alleviate the pain, though nothing is likely to be of much assistance. We first of all remove the sting if possible. This is done by pressing over the place where it is the mouth of a watch-key, thus squeezing it partly out. Then we can pull it out. But whether we can extract it or not, we bathe the part with weak ammonia and water, or a weak solution of washing-soda, or with an antiseptic solution. Then, if the sting is very bad, we put a strip of gauze dipped in the solution upon the stung part and apply a wet dressing. If the patient has been stung so badly as to be in a state of collapse, we treat him for shock in the way described earlier in this lesson. For bad nettle stings we apply the same treatment.

In case of a bite from an adder or a dog or other animal we should press with finger and thumb on the side of the wound nearest the heart, while someone else, as speedily as possible, ties a tape or string tightly round the limb to hinder the circulation of the blood, and thus prevent the poison from spreading. It is well to allow the wound to bleed a little. It must be bathed with warm water, and the best sponge is a piece of clean cotton. A doctor should see the wound as soon as possible.

POISONING

Cases of poisoning must be treated at once, as life very often depends upon the promptness of the aid rendered.

Poisonous acids, like oxalic acid, spirits of salt, and so on, and poisonous alkalies, like ammonia, caustic soda, and so on, burn and stain the mouth. When the poison is an acid we wash the patient's mouth out with an alkaline mixture, such as soda-water, chalk and water, or magnesia and water. If the poison is an alkali, we wash out the patient's mouth with an acid solution, such as vinegar and water, or lemon-juice. Then, whether it be acid or alkali that has caused the poisoning, we give the patient oil—salad oil or cod-liver oil.

In all other cases of poisoning than those caused by acids or alkalies the patient should be treated in the following way: First of all an emetic must be given to make him emit the poison. This should be made of 2 teaspoonfuls of mustard or 1 tablespoonful of salt in a tumbler of warm water, either of which form an excellent emetic. The back of the patient's throat may also be tickled with a feather or some other similar object, as this will assist the emetic.

If the patient retains his senses, he should have some milk or a raw egg beaten up in some milk, either before or after the emetic. If the throat is swollen, hot flannels or poultices should be applied to the front of the neck, and cold water should be sipped constantly. Should the patient show any signs of sleepiness, keep him awake by making him walk up and down the room, or flick the face and neck with a towel. Strong coffee without milk is a very good thing to give. If breathing cannot be noticed, artificial respiration must be applied.

If oxalic acid is the poison, soda or potash must not be given. If the poison is phosphorus, no oil should be given. For carbolic acid, milk, to which ½ ounce of Epsom salts has been added, should be given. If poisoned by prussic acid, the patient must have artificial respiration applied, and cold water should be thrown continuously on the head and spine. For poisoning by bad fish or meat, or by toadstools, we should give an emetic, and then when this has done its work, we should make the patient take a strong dose of castor oil.

FITS

We sometimes see in our streets a man in an epileptic fit, and it is usual for people to hold his limbs tightly in order to stop his convulsions. This is quite wrong. We should not restrain the movements, except to prevent the patient from injuring himself. A piece of wood or similar object should be wrapped in a handkerchief and placed in his mouth to prevent him from biting his tongue. The head should be supported.

FAINTING

In fainting and also in other instances of insensibility the person should be laid down with his head slightly raised. All tight clothing should be loosened, plenty of fresh air provided, but nothing given through the mouth until the patient recovers consciousness. Water may then be given, and if the patient wishes to sleep he should be allowed to do so. If an insensible patient shows no signs of breathing, artificial respiration should be applied.

SUNSTROKE

A patient suffering from sunstroke has the skin very hot, especially round the head and neck. He is very faint and giddy, and probably breathes with great difficulty, either too slowly or too hurriedly. He must be laid down in a cool place, with his head and shoulders slightly raised, the throat, head and chest must be freely exposed to the air, all tight clothing must be loosened, and the patient must be fanned so as to be sure that he gets plenty of fresh air. The head, neck and spine should be bathed with cold water.

ELECTRIC SHOCK

If a person has received an electric shock through the accidental touching of a live wire, first aid must be given at once. As in cases of drowning, the sooner treatment is begun the better. The clothing around the neck and body must be loosened and an effort made to restore breathing by the same artificial-respiration methods as those used in resuscitating patients who have been nearly drowned. Striking the soles of the feet repeatedly will be of great assistance.

The next lesson in first aid is on page 6147.

HOW TO KNOW THE WOODS IN FURNITURE

If we examine the furniture in our homes—the tables, chairs, bookcases and cabinets—or if we look around a furniture store, we will see at once that different articles are made of different kinds of wood. Perhaps we have wondered what these various woods are called, from what trees they come, and in what parts of the world they grow; and it is intended to give here a few particulars which will help us to identify the woods of which most of our furniture is made.

MAHOGANY

Perhaps the most conspicuous of all the timbers used for furniture is mahogany. We can tell it by its deep rich red color, and it seems to take French polish better than other kinds of wood. There are two kinds of mahogany principally used in furniture making—Honduras mahogany, which has an almost straight grain, and Spanish mahogany, in which the grain is more twisted. This grain gives a dark, rather streaky appearance to the wood, which adds to its richness. But if we look out for a really deep red wood highly polished, we cannot very well mistake mahogany. We frequently see it used for shop fronts and for shop counters. Honduras mahogany comes from Central America and Spanish mahogany from the West Indies.

WALNUT

Even more common than mahogany is walnut. This has a grayish brown color with black-brown pores, and is finely veined with darker shades of brown. It is the wood that the stocks of rifles are made of.

ROSEWOOD

Another wood much used for cabinets and grand pianos is rosewood. This is a very richly colored and marked timber, and is, perhaps, the handsomest of all woods used for furniture. The color is a reddish brown—redder than walnut and browner than mahogany. The texture is very fine and the surface takes a high polish. The markings, which are of a handsome dark color, vary very much, and are sometimes like watered silk, and at other times like a beautifully grained marble. The rosewoods from Brazil are more handsomely marked than those from India.

OAK

Oak is largely used in the making of furniture, and varies a good deal in its depth of color. Some kinds are almost of a fawn, or buff, color; other kinds are so dark as to be almost black, and in between there are various shades of brown. The grain of oak is unlike other woods used for furniture, being close, compact and straight. The lines are not continuous but are broken, being almost like dotted lines.

EBONY

Ebony is a black, heavy, hard and shiny wood that comes from an Indian tree related to the date palm; but various other woods from Africa, the West Indies and Texas are also called ebony. German ebony is simply yew-wood stained black. All these are so alike that only an expert can tell the difference.

MAPLE

Maple is a fine-grained, light, yet low, wood, much used for bedroom furniture in our own country. Some of it is full of little whorls or specks. This is called bird's-eye maple, and is highly valued, though many people think it less beautiful than the plainer varieties.

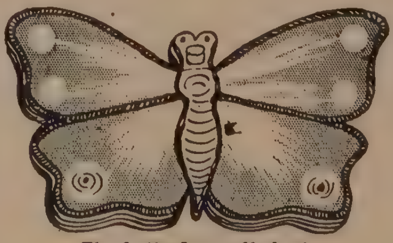
These are the principal woods used in furniture. Of course, much of the cheaper kinds of furniture are made of pine, and are merely stained or veneered—that is, covered with a very thin layer of some better kind of wood. On page 5889 will be found an account of an interesting hobby—that of collecting different kinds of wood.

A BUTTERFLY NEEDLE-BOOK

A novel little needle-book can be made in the form of a butterfly. If we turn to the colored pictures beginning on page 6533 we shall see many different kinds of butterflies which may suggest to us shapes and colors suitable for imitation.

Perhaps a scrap of peacock blue or light green velveteen is as pretty a material as we can choose. A piece of white nun's-veiling, delaine, or thin flannel for the leaves of the book and a small piece of stiff calico for the foundation will also be needed.

We first draw the outline of the butterfly on paper, using this as a pattern, and in doing this we shall not find any difficulty. Then we cut out the velveteen which is to make the top of our needle-book, together with four thicknesses of nun's-veiling and one of calico. It may be that we possess the apparatus for doing burnt-wood work easily and quickly in our homes. If so, with it we can indent the outline of the wings, and mark the ridges on the body. Two spots are made in the back of the wings, and pressure with some rounded tool, or even a thimble, will make the shiny markings left white in the picture on this page.



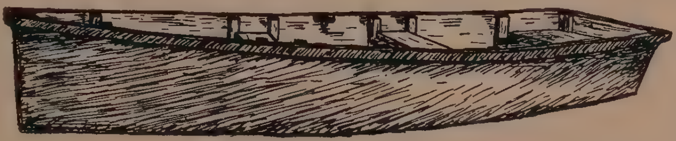
The butterfly needle-book.

Placing the calico at the bottom, the layers of nun's-veiling next, and the velveteen on the top, we take a needleful of brown thread—embroidery floss will do—and stitch round the outline of the body through all the thicknesses, with long stitches. If we are accustomed to use brushes and paints, we can get pretty effects with hardly any trouble. A little lustre paint imitates well the brilliance of beautiful butterfly colors. We can thus have a favorite butterfly always before us.

HOW TO BUILD A FLAT-BOTTOM BOAT

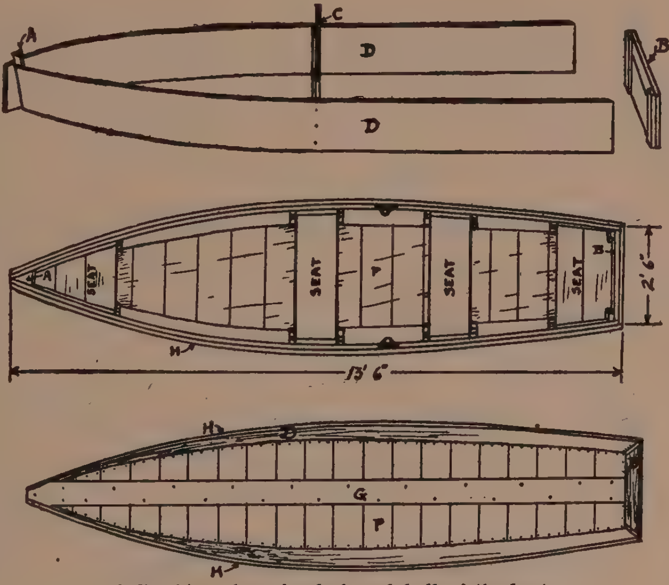
WHY not plan to build your own boat for vacation use? This flat-bottom boat shown in picture 1 is a good model for a boy to build, because of its simple construction and the small amount of material required. This type of rowboat is excellent for fishing, for the bathing beach, and the like. In fact, it is well adapted to the use of an outboard or portable motor.

A satisfactory material to use for such boat-building is cypress, as this wood has considerable resistance to rot. Next in desirability to cypress is cedar, also famed for durability, and third best is perhaps pine. It is important to select seasoned material which is free from knots, checks and other defects. A decided disadvantage in using green material is that it shrinks considerably in drying-out, and is apt to give continuous trouble in keeping the seams properly calked.



1. Flat-bottom boat complete.

In picture 2 is given a deck plan of the flat-bottom boat shown, together with a plan of the hull and the assembly of stem-piece *A*, stern-piece *B*, centre mold *C* and side boards *D*. In making this splendid boat you should first prepare the stem-piece by the pattern shown at *A* in picture 3, out of a piece of 2 by 4 or a piece of 3 by 4 if you can secure it. The stern-piece *B* may be built up of 1-inch wood. However, if there is a possibility of employing an outboard motor for propelling, it will be better to use 2-inch planking, as this will give more nailing surface for the side boards and thus add rigidity. Since vibration in the latest type of motors has been reduced to a minimum, it is a factor that hardly need be considered.



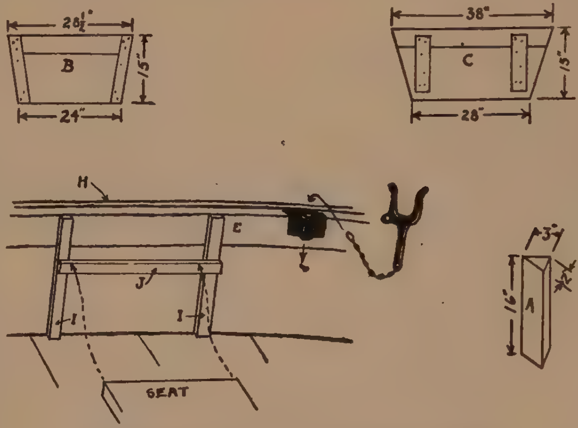
2. Working plans for deck and hull of the boat.

Now fasten together the stern-pieces with a pair of strips 1 inch by 3 inches, placing these even with the ends, as shown at *B* in picture 3. The centre mold, *C*, is a temporary piece around which the sides are more easily shaped. Its dimensions are given in full. You should make it of 1-inch material, fastening the pieces together as shown. The sides of the boat are to be made 15 inches wide. So-called 1-inch lumber is usually not over 13-16 of an inch thick, while 12-inch boards are ordinarily the widest material carried in stock, and their actual width will be found to vary between 11½ inches and 11⅝ inches. The sides of the boat will have to be built of two pieces, consequently a 12-inch board and a 4-inch board will do.

In assembling the boat, locate the centre of the length of the side boards *D*, and fasten the boards at these points to the ends of centre mold *C* (picture 2). Bright wire nails may be used for this nailing. For all other permanent nailing copper, galvanized, or cement-coated nails, or brass screws must be used. First set stem-piece, *A*, in position and nail one of the side boards to it. The bow of the boat should have a rake, or pitch, of 3 inches between gunwale and hull. Then set the stem-piece at the right angle to provide for this pitch. After fastening one side board, saw it off even with the stem-piece (picture 2), and then nail on the second board and trim it in the same way.

The stern also has a pitch of 3 inches. Mark the pitch upon the end of boards, *D*, then set stern-piece, *B*, at the proper angle and nail the side boards to it. Ask someone to help you bend and fasten the side boards, as it is difficult to do this alone, because the changes in pitches producing the stream lines necessitate twisting the boards as well as bending them. It will simplify drawing in the side boards to meet the ends of stern-piece, *B*, if a cabinet-maker's clamp is used, or a doubled piece of wire looped over a nail is driven into the ends of each side board and twisted with a nail or bolt until the board-ends are pulled in the required distance. After nailing or screwing the side boards in place, trim their ends flush with the stern-piece, as shown.

The next step consists in inverting the framework and nailing on the bottom boards. These should be 6-inch or 8-inch boards with straight edges (not tongued and grooved). The boards will vary in length, and should be trimmed to conform to the shape of the boat sides. Do not bother about the exact angles in cutting. Just cut the ends square and a trifle longer than necessary, leaving the final trimming until after all boards have been nailed. Then it will be found a simple matter to saw them off close to the boat sides and to finish the edges with a file and sandpaper. White-lead paint, somewhat thicker than that used for ordinary painting, should be applied to make all joints water-tight.



3. Additional details for constructing the boat.

When the boards are nailed, right the boat and fasten the upper side boards, *E*, in place, as in picture 3. Battens are then necessary to bind the side boards together so the joints between will be tight. These should be spaced to come at the right points at which to nail cleats for seat supports. In picture 3 the battens are marked *I*.

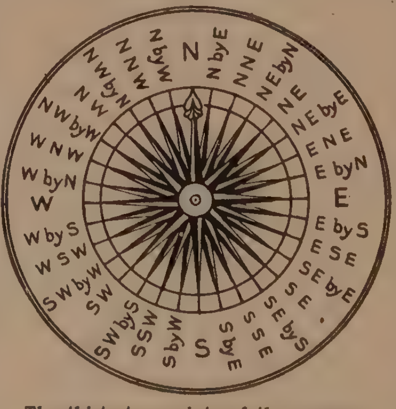
Now to complete the outside of the boat, nail or screw the upper edge of each side, or gunwale. Invert the boat, and then along the centre of the bottom, extending from bow to stern, screw a 6-inch board for a keel, *G*, picture 2. Some builders also prefer to fasten a similar board, known as a keelson, to the boat-bottom, inside.

The seat in the bow should be built of three pieces having a total depth of 24 inches. The stern seat can be made of two boards having a total depth of 16 inches. The other two seats are made of 10-inch boards. Next fasten a cleat, *J*, across the side battens to support the seat-boards, as in picture 3. Then place the cleats about 9½ inches above the boat-bottom. With the seats in place, you may now remove centre mold, *C* (picture 3), as it is no longer needed.

If you have carefully followed these plans, your boat is ready for painting.

HOW TO READ THE MARINER'S COMPASS

EVERY boy, especially every boy scout, ought to be able to read the mariner's compass—that is, to repeat the 32 points from the North by the way of the East and round to North again—without any hesitation. This is one of the first things that midshipmen and sailor boys are taught to do, and they also learn to read it backward so as to be thoroughly familiar with all the 32 points. It is only when we know them properly that a compass becomes of real use to us when out sailing or walking. The picture here shows the position of the 32 points. The four cardinal points are marked N, S, E and W, and represent North, South, East and West. The arrangements of the points between the cardinal points are similar in all four quarters of the compass card. Midway between N and E is Northeast, marked NE, and midway between N and NE is NNE, called North-north-east. The point midway between NE and E is East-north-east, marked ENE. The remaining points are N b E, called North by East; NE b N, North-east by North; NE b E, North-east by East; and E b N, East by North. The other quarters of the card have corresponding names. As we know, the magnetic needle usually points to the magnetic pole, and not to the geographical pole. The difference between the two directions is called the variation, and as the variation of the compass differs in different parts of the world, sailors have to learn how to allow for this, wherever they may be. If the variation were not taken into account by seamen, the consequences might be very serious indeed, as even a slight deviation from the true course that should be sailed by a ship might possibly send it upon the rocks, and result in the vessel being wrecked.



The thirty-two points of the compass.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 6141.

A trainload of logs cut from a redwood tree.

THE WEALTH OF THE FOREST

WE have read, on page 2803, about the forests of the United States and their guardians. Now we shall read of the way in which men take from the forests lumber for building and other purposes. The chief regions where timber was cut before 1870 were the New England and Middle Atlantic states. Ten years later the Lake states were leading in lumber production, to give place later to the southern states and finally to the Pacific coast states. Nowadays 61 per cent of the softwood saw timber is found in the Pacific coast forests. The best softwood trees are the Douglas fir, southern yellow pine, western yellow pine, western hemlock, true fir and redwood. The best hardwoods are found in the eastern forests, and they are oak, birch, beech, maple and red gum. There are many other trees of both kinds which are useful as lumber, and of these you may read on pages 4507 and 4635.

We are interested now in the method of getting the trees out of the forest and to the mill where they are cut into planks. Early logging was carried on near settlements where the surface of the country was favorable. The work was done largely by settlers who cut the logs during the fall and winter and hauled them over the snow to the mill or to a river which ran to a mill.

The first lumbermen in the United States used to fell all their trees with axes, but now a logger uses an ax for small trees only. By this method a wedge-shaped notch, or undercut, is made on the side of the tree-trunk in the direction in which the tree is to fall. On the opposite side to the undercut, and slightly higher, the woodman cuts another wedge-shaped notch deep into the heart of the tree until the tree falls. That is a wasteful method, so now a crosscut saw is used to aid the ax. The undercut is made as usual, but the saw is used to cut through the trunk. As the saw eats into the tree, wooden or iron wedges are driven into the cut behind it. A crosscut saw needs two men or a gasoline engine to operate it, and the mechanical saw is coming into use more and more.

When the tree is lying on the ground an ax is used to lop off the limbs. Sometimes the trunks are cut by crosscut saws into logs varying in length from ten feet to sixty feet, according to the kind of tree and the method of getting logs to the mill.

There are many ways of transporting the logs from the forest. The logging engineer uses sleds, wagons, railroads, aerial trams, slides, flumes, steam and electric skidders, tractors, tugs and barges, according to his idea of the cheapest form.

Where the land surface is rough, flumes and slides may be used. A flume is a wooden trough, sometimes miles in length and wide enough to take a large log. This trough is filled with water on which the logs are floated to their destination. Slides are chutes running down hillsides, and they may be just grooves in the earth or they may be made of timber. When a log is placed on the top of the slide, or chute, gravity keeps it sliding until it reaches the bottom. Often the chute ends in a stream.

Where the land surface is comparatively flat, wagons drawn by horses or tractors may be used to haul out the timber. Often a railway line is run into a thickly wooded country and the logs are loaded on to flat cars. Those who have seen railway engines hauling cars of logs may have wondered at the strange-shaped box on the smoke-funnel. This is a spark-arrester with a screen which lets steam, smoke and gas pass through, but catches all the dangerous bits of fiery material that might set a whole forest on fire. The laws of most states require the use of a spark-arrester on wood-burning and coal-burning machinery used in the woods.

Sometimes the logs are dragged, or "skidded," along the ground. This method is used for short-distance hauls and with shorter logs. Transporting long logs in this way bruises or breaks a large amount of young growth. In the eastern part of the United States a sled called a go-devil is used in the summer and fall for hauling. This rough sled has two unshod hardwood runners curved up at the front, and is pulled by chains. In sections of the country where there is a heavy snowfall, during the winter real snow-sleds are used to transport the logs to the nearest icebound stream of adequate depth. The logs are unloaded on the ice, and when in the spring the ice "goes out," the logs float downstream with the current. The sight of a river full of logs is one not to be forgotten.

Water transportation has always been a great factor in lumbering in this country. Nearly every large stream in the forest regions has, at one time or another, floated logs to mill. The use of rivers as lumber highways is still a common method of lumbering in the eastern states. On the Pacific coast water transport, except on the Columbia River, Puget Sound and the Pacific Ocean, is of secondary importance because of the great diameter and length of the logs.

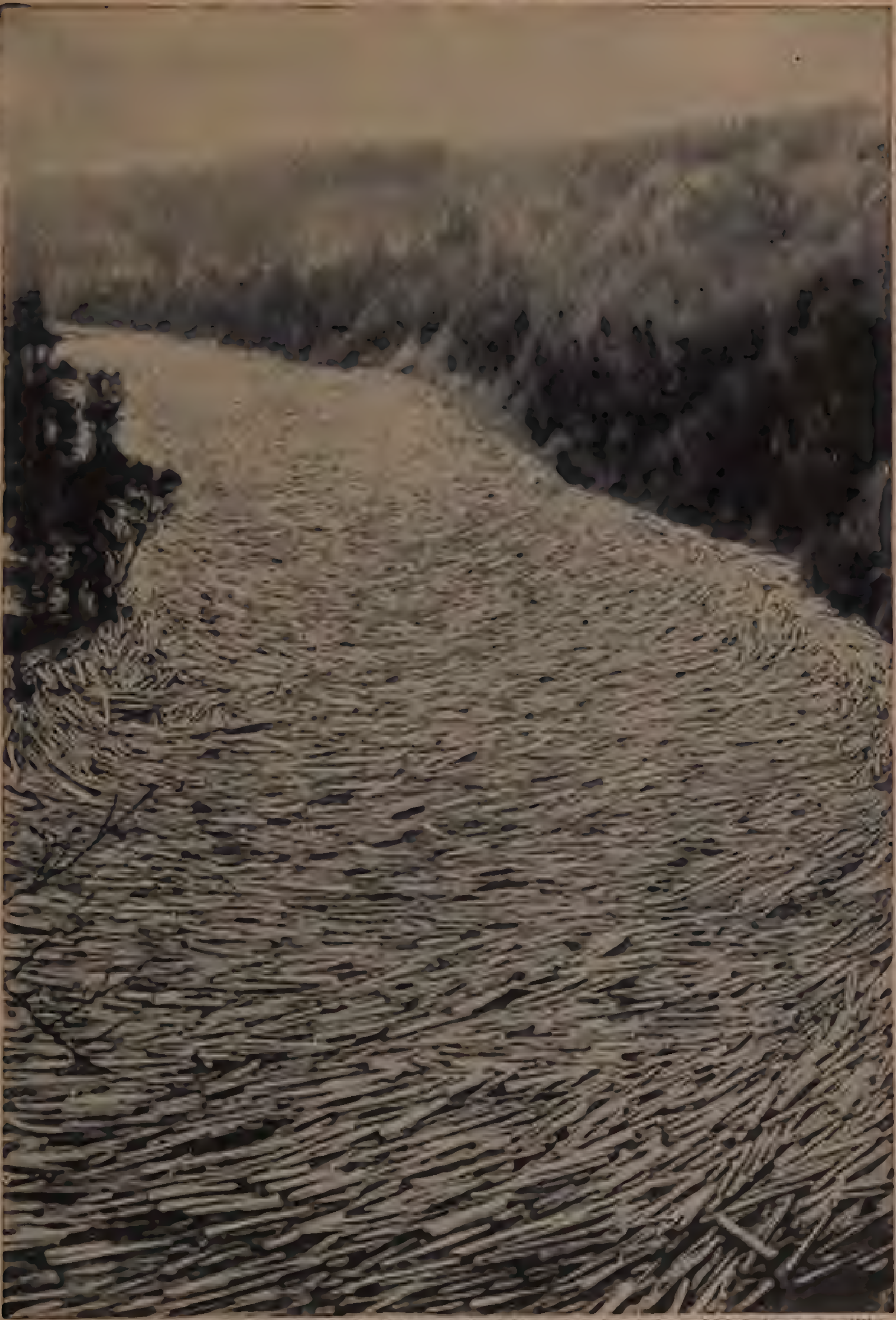
Where water is used logs may be floated singly or in rafts. On rough water and small streams rafts are rarely used. On navigable rivers rafting is compulsory. Water transport is the cheapest method of moving logs for long distances, but it has disadvantages. It is limited chiefly to logs which will float, so many hardwoods cannot be carried. There is always a loss through sunken and stranded logs, and also logs are often badly battered by passing over rocks, rapids or falls. Floods and storms are sources of loss to lumbermen who work on large streams, for the booms confining the logs break, and loose logs are carried downstream past their destination. As each log is branded or painted with the owner's sign, some of the lost property may be recovered, but a lot is lost.

In the Pacific coast region logs are often rafted down the larger streams and towed along Puget Sound to the mills. But the log rafts of greatest interest are the huge cigar-shaped ones which are towed from the mouth of the Columbia River to San Diego, California. These rafts are known as the Benson type, and are from 700 to 1,000 feet long, from 50 to 60 feet wide and from 30 to 35 feet deep at the centre. These ocean-going rafts are bound together by strong chains. A 700-foot raft containing from 4,000,000 to 5,000,000 board feet is bound with about 115 tons of chain. An ocean tug tows this giant across 2,000 miles of ocean.

When the logs finally arrive at the sawmill they are subjected to many kinds of saws before the finished planks are carried out into the lumber yard to be seasoned and before being sold for building purposes. Seasoning, that is, removing the moisture from the lumber, is done in two ways. In small mills the lumber is seasoned by piling it out of doors to dry in the open air. In large mills there are dry kilns, or heated rooms in which the lumber is dried. The outdoor method is better, but it takes a longer time than the other. The pictures which form part of this article give a very good idea of different stages in lumbering.

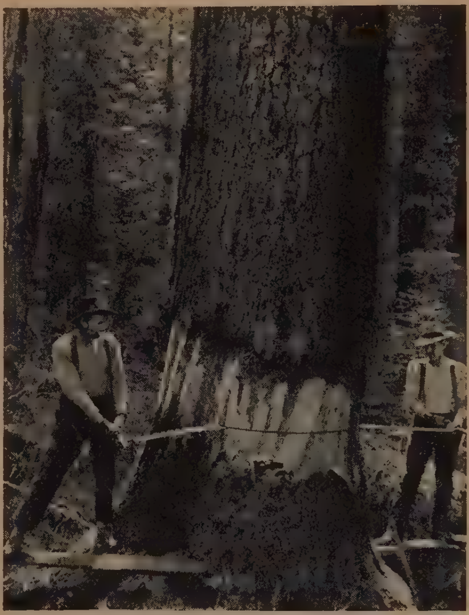
THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6037.

A LOG DRIVE ON A RIVER

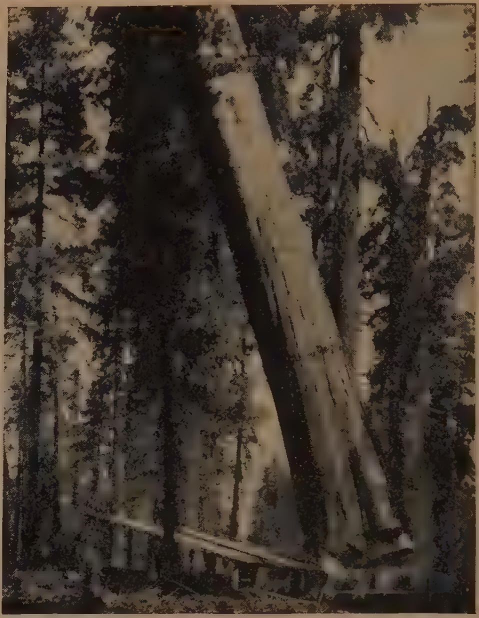


This wonderful photograph shows hundreds of thousands of logs of timber being whirled down a swiftly flowing river. Such a mass of timber flowing by is a very striking sight.

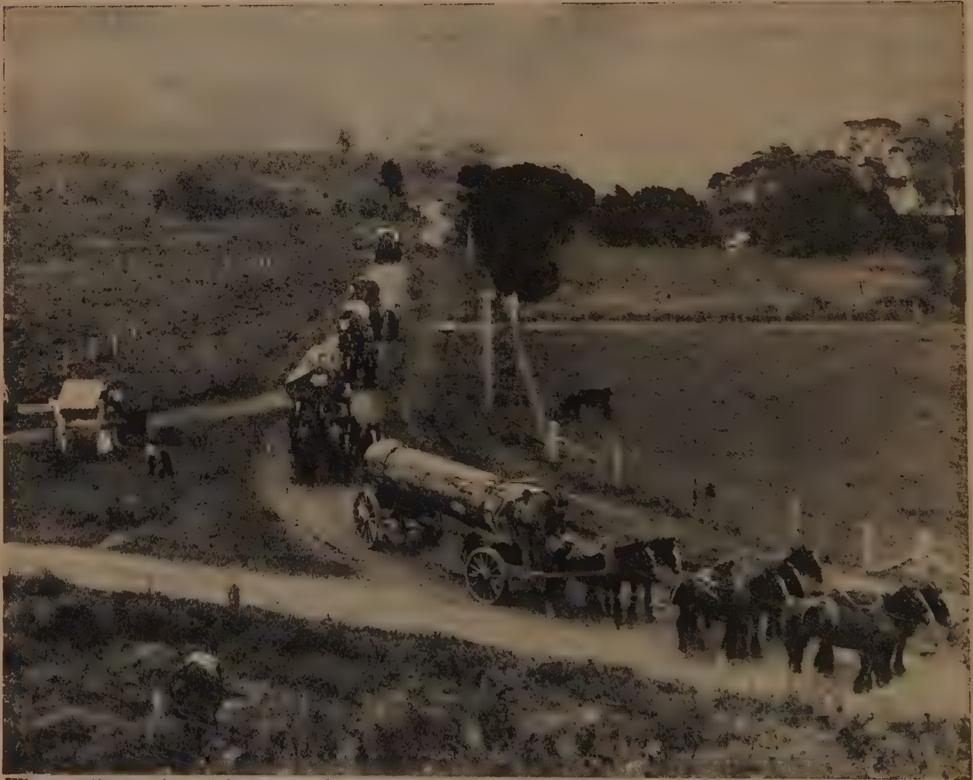
THE END OF A GREAT TREE



Small trees are felled with the ax, but the giants of the forest are sawed down. Here two men are sawing through a tree in an Oregon forest.



Having sawed through the great tree in such a way that it will fall in the direction desired, the men step aside while the tree crashes to earth.

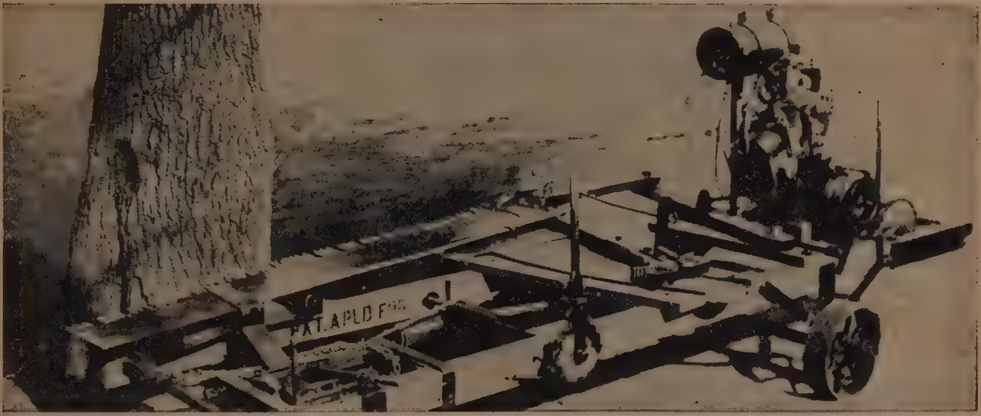


Where railways do not happen to be near, and there are good roads, the timber is placed on vehicles specially built for carrying tree-trunks, and is drawn by horse power to the town or mill.

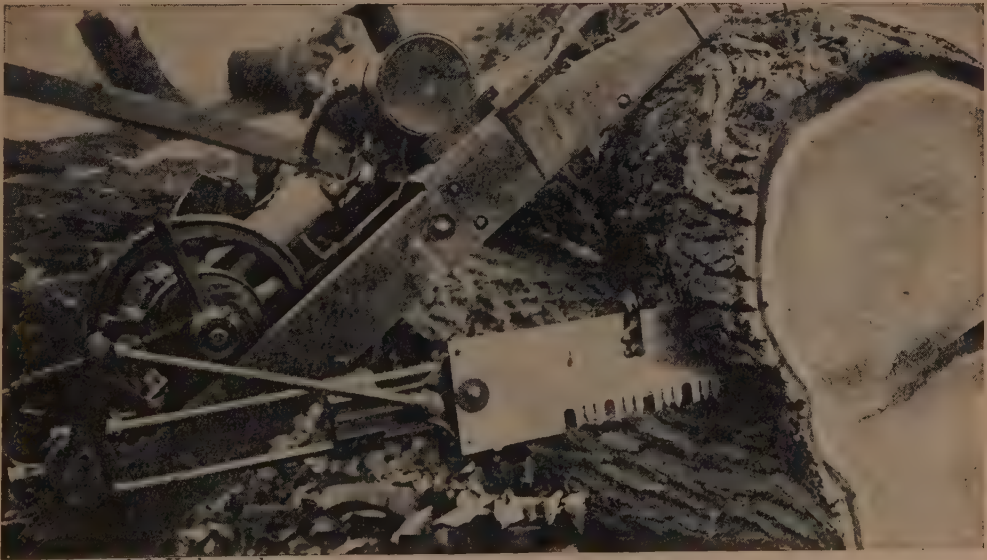
The picture in the upper left corner is copyrighted by Underwood & Underwood, New York.

THE BIG SAWS IN THE FOREST

The big saws that are used for felling trees are not like the small saws used by the carpenter. Hand-saws have two handles, and the teeth are generally arranged at intervals in groups of three.



Mechanical saws worked by small portable engines are used in many parts of the United States, and here we see one felling a tree. The backward-and-forward movement is very rapid.



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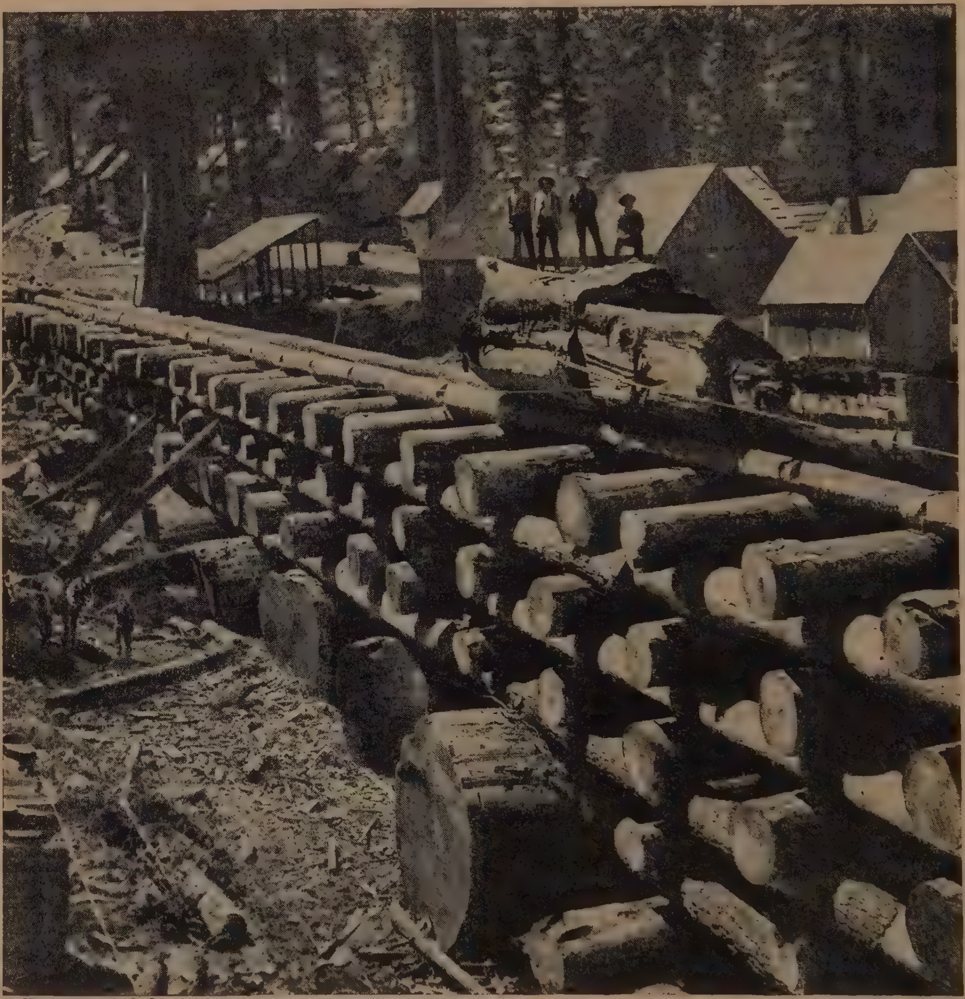
When giant trees weighing several tons are felled they are sawed up into convenient lengths in the forests. A giant tree is sawed through by a mechanical saw worked by power in four minutes.

THE TREES MOVE ALONG THE SKIDWAY

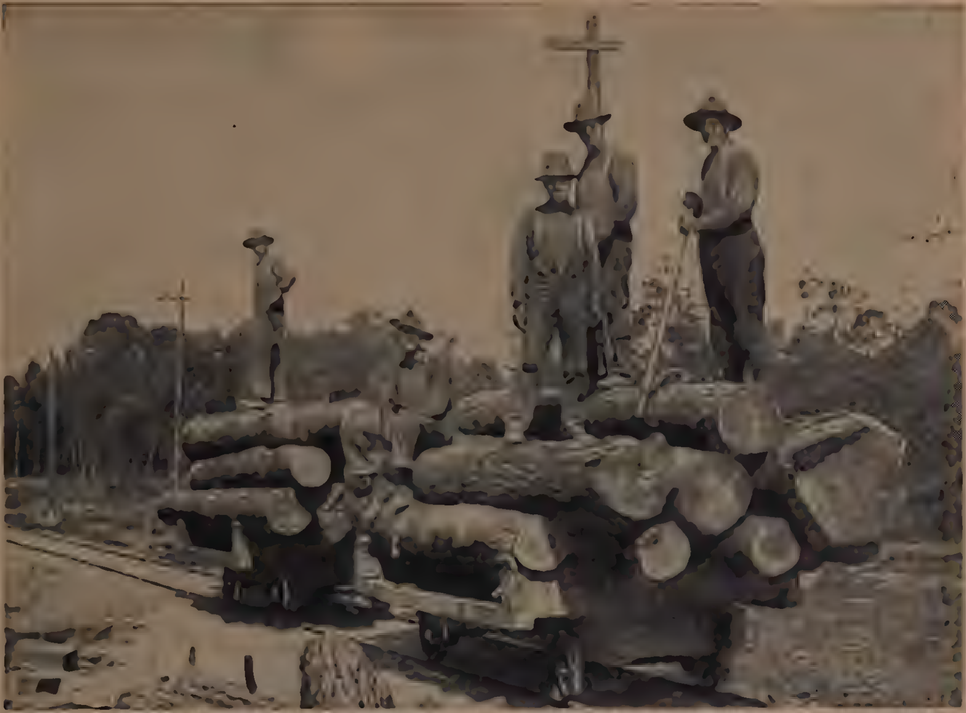


© Underwood & Underwood.

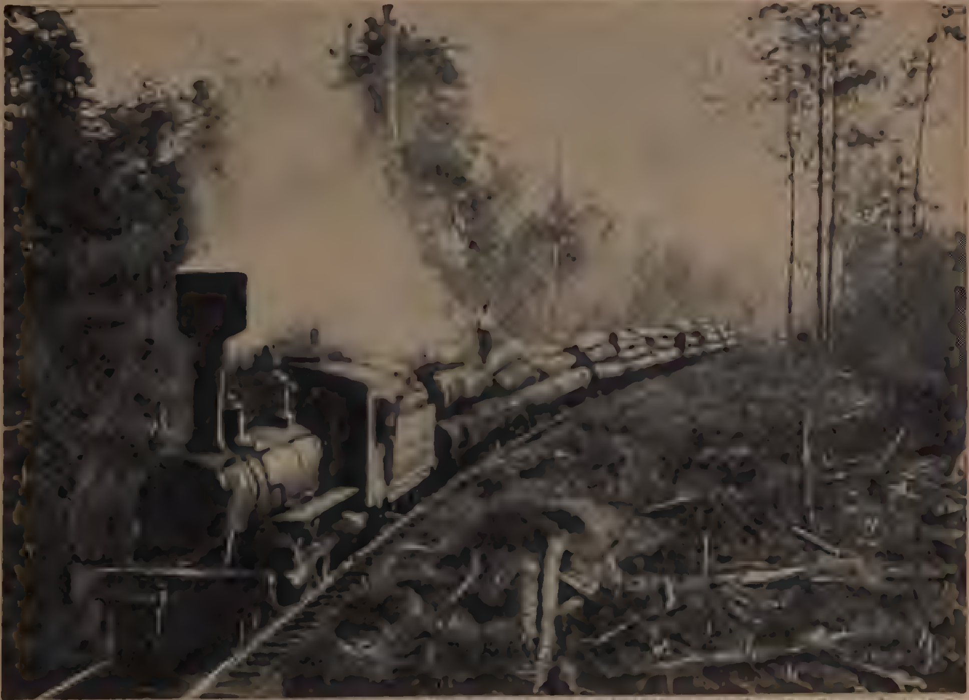
Where the sawmill is in the forest among the trees that are being felled a skidway is often built up of logs, as shown in this picture, and the felled trees are hauled along this to the mill.

Here we see the logs at the foot of the skidway ready to be hauled up to the mill for conversion into beams and planks. They are drawn up by a chain or wire rope.

THE LOGS TRAVEL TO THE MILL BY RAIL



Sometimes a light railway is laid down from the place of felling to the sawmill, and the logs travel on small trucks propelled by hand. Such trucks are also used on ordinary railway tracks through the forest.



When the felling is taking place near a railway the logs are loaded on to low trucks and sent by locomotive either to the sawmill or to the nearest port for dispatch to the centres of civilization.

LOADING AND UNLOADING THE TREES

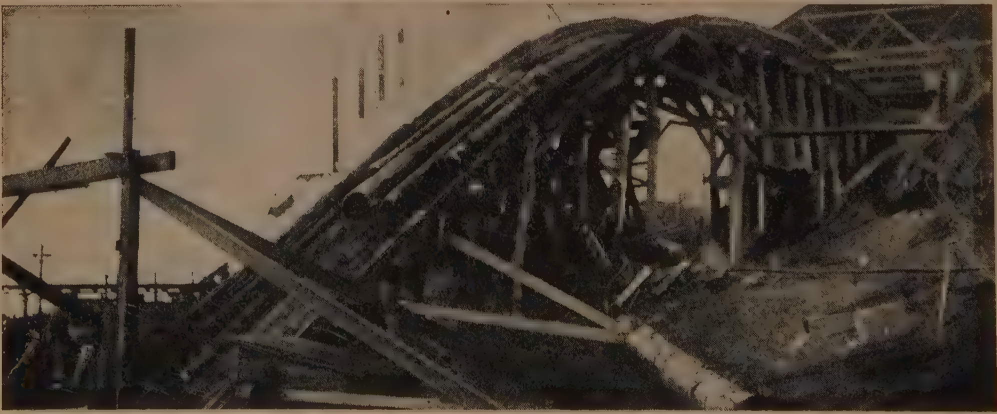
To load up the trees on vehicles that will convey them to the sawmills various means are used, one of which is an engine with a steel rope.

The rope is placed around the trunk of the tree; the engine then winds the rope up, the tree being drawn along and up sloping poles to the vehicle.

Sometimes the trunks are merely drawn along the ground by horses harnessed to a steel grip in the form of tongs, which seize the end of the trunk.

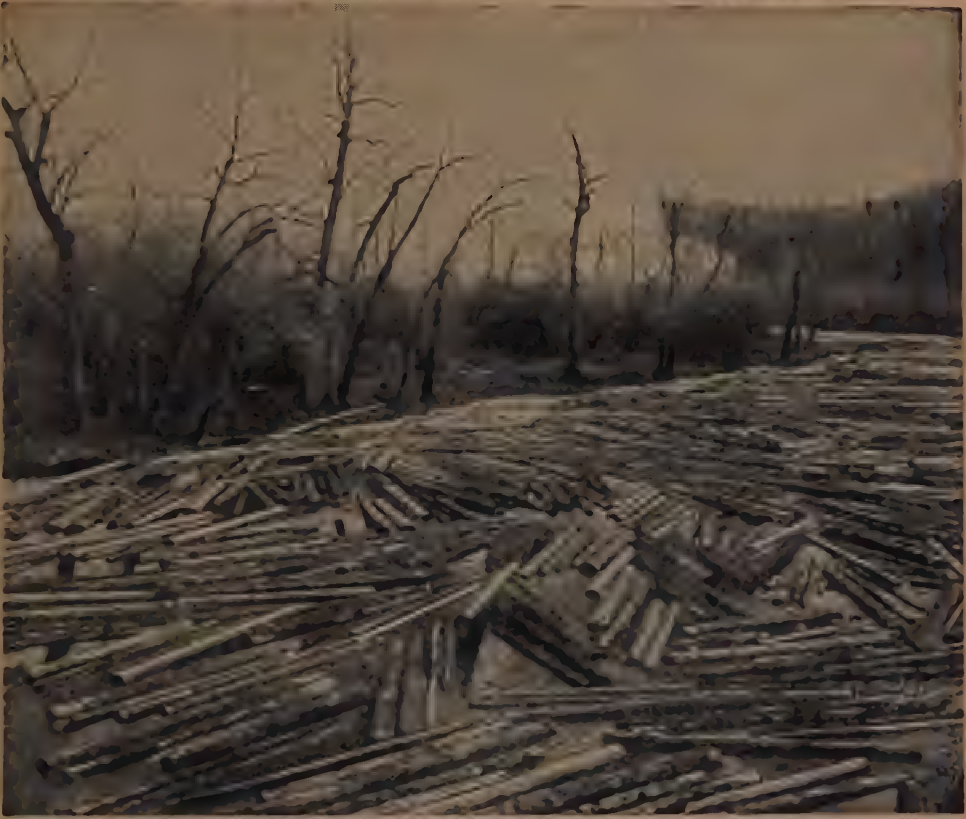
When the trees arrive at their destination they are unloaded from the vehicles down the sloping poles.

To move the logs any distance they are often rolled on a runway consisting of two rows of logs.



When the level of the sawmill is above the ground a strong timber chute is built. Up this the logs are drawn by steel ropes or chains.

THE LOGS ARRIVE AT THE SAWMILL

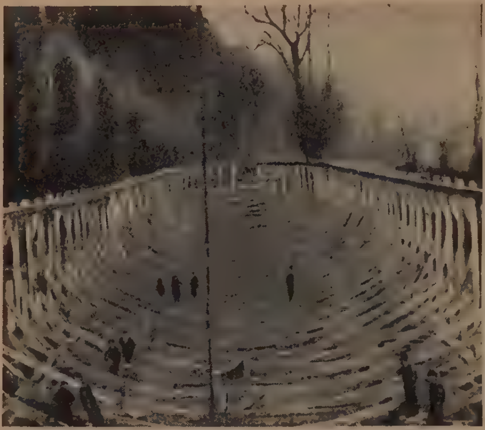


The jam having been relieved, the procession of logs again begins to move down the river, with the stream, toward the mill. This photograph was taken on the St. Maries River, in Idaho.

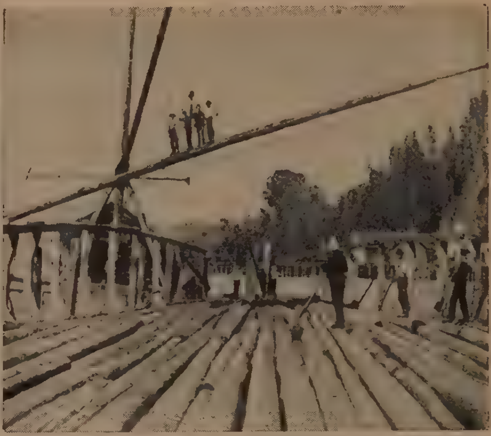
Arrived at the mill, the logs are dragged to shore, and an endless chain fitted with hooks, or some similar device, drags them up a slanting way.

Not only small trees, but large ones, reach the mill in this way, and here we see some bigger timber being drawn from the river up into the mill.

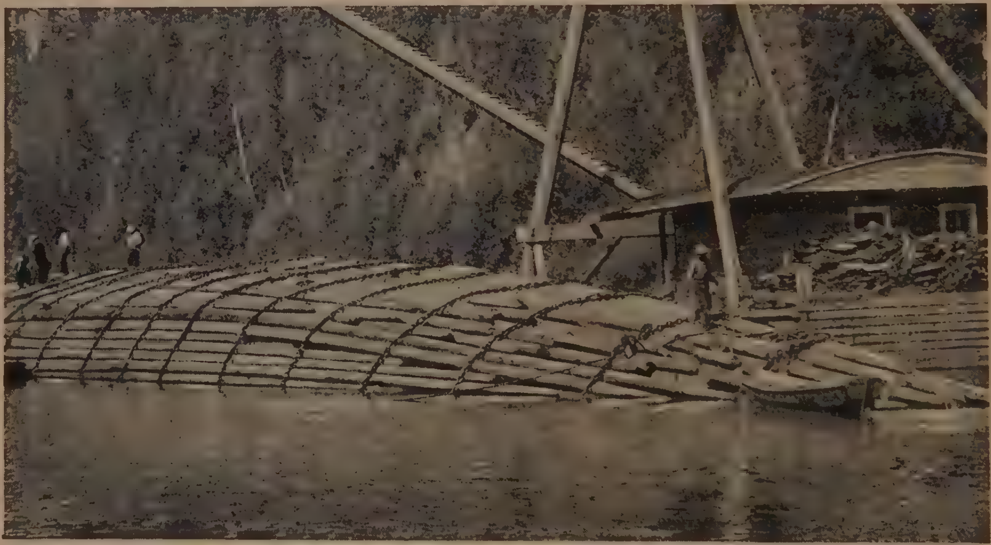
BUILDING A GREAT RAFT OF LOGS



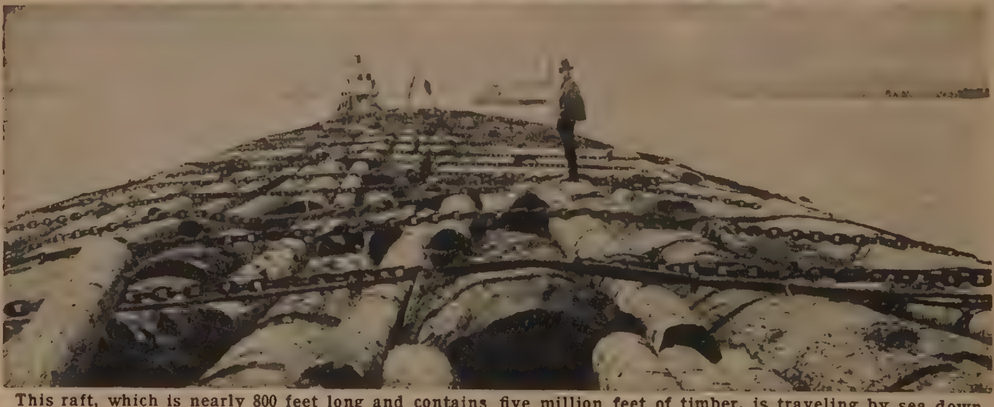
Sometimes millions of feet of lumber from the vast forests of North America or Scandinavia are made up into giant rafts in a cradle such as this.



These rafts are sent vast distances by river and sea, and here we see the lumbermen beginning to build the lumber into a giant raft inside the cradle.

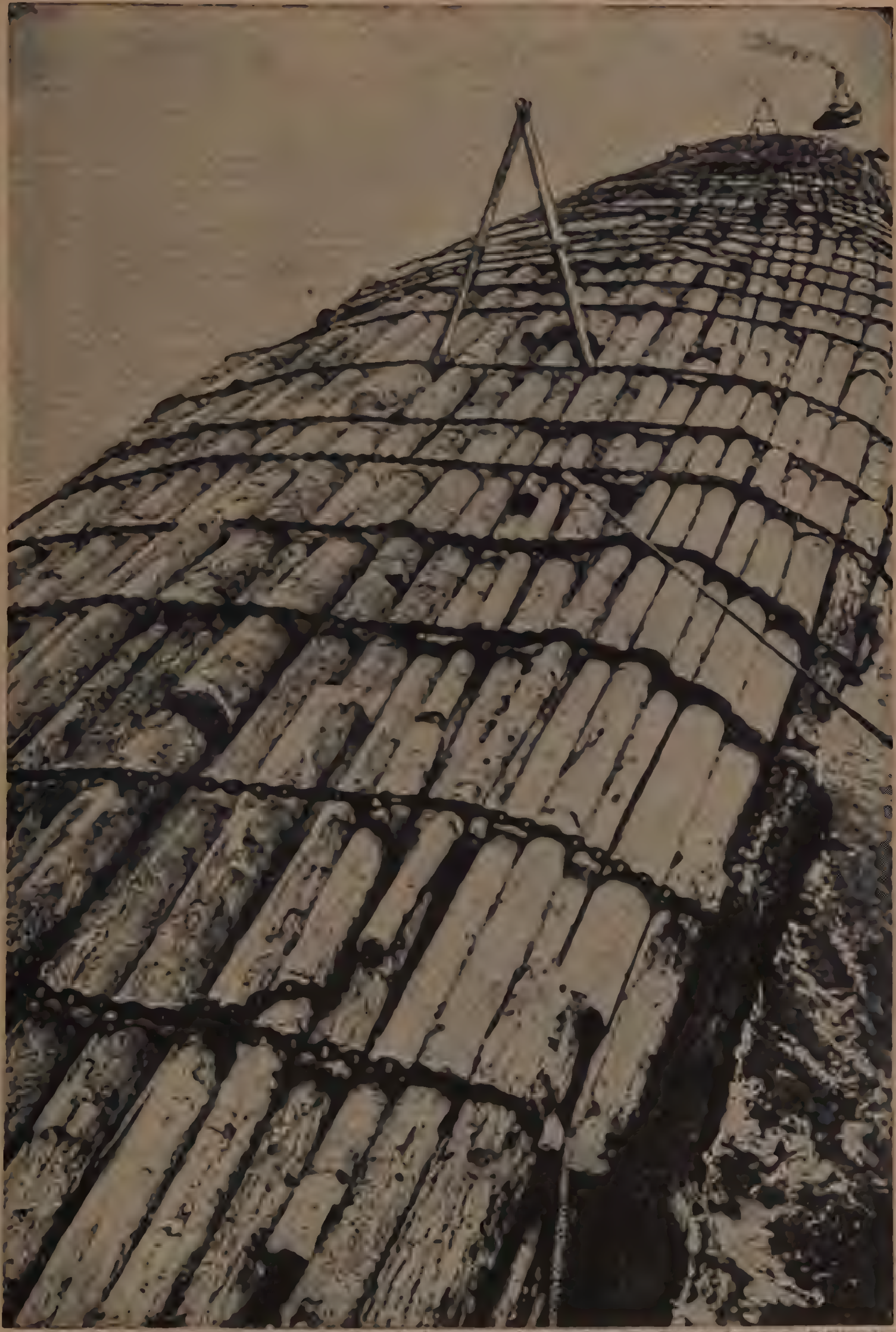


Here the raft has been completed, the logs being held in position by great chains that pass right around the raft, which has just left the cradle and is in the river, about to start on its voyage.



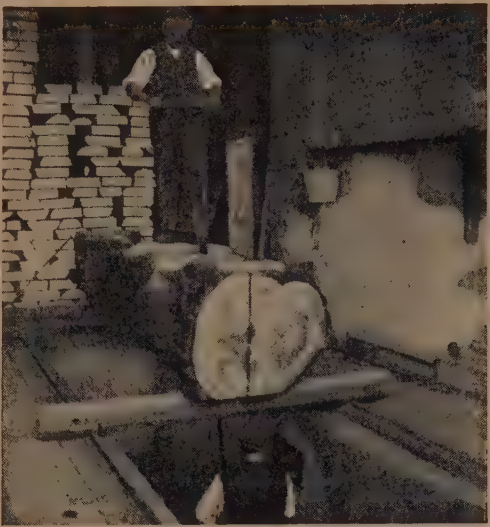
This raft, which is nearly 800 feet long and contains five million feet of timber, is traveling by sea down the Pacific coast. It was towed into San Diego harbor, after an ocean journey of two thousand miles.

A RAFT AS BIG AS THE MAURETANIA

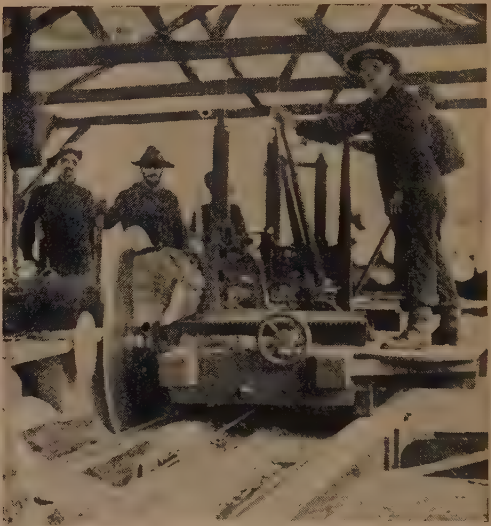


Here is a closer view of the giant pine raft on its long ocean journey from the Oregon forests to California. It is as big as an ocean liner, and men travel with it and live on it during the journey.

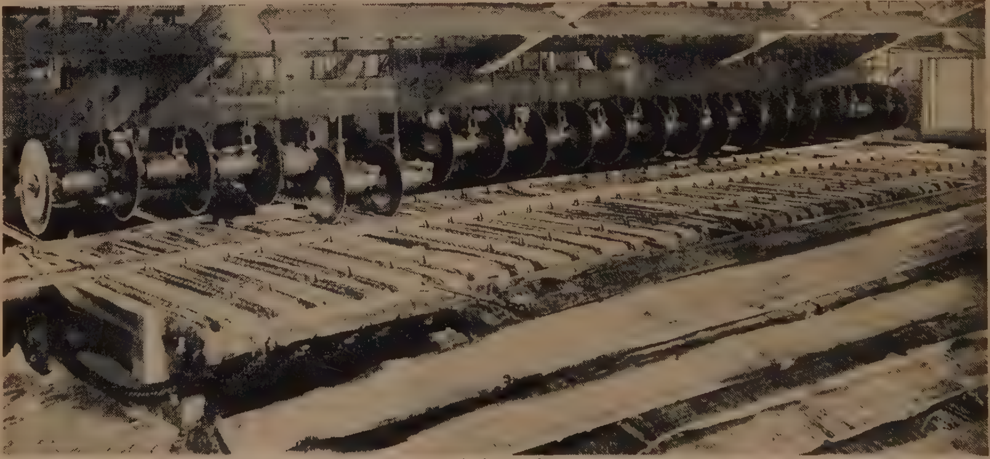
THE LOGS ARE SAWED UP READY FOR USE



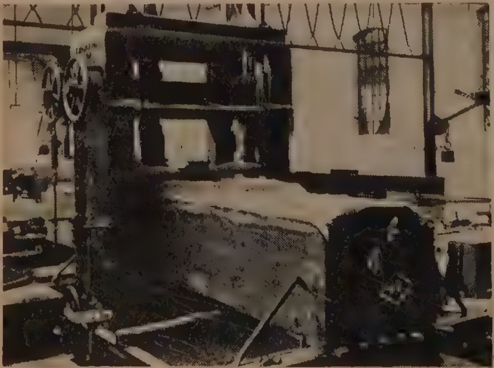
Sometimes the logs are sawed up by hand in a saw-pit, by two men using a double-handed saw.



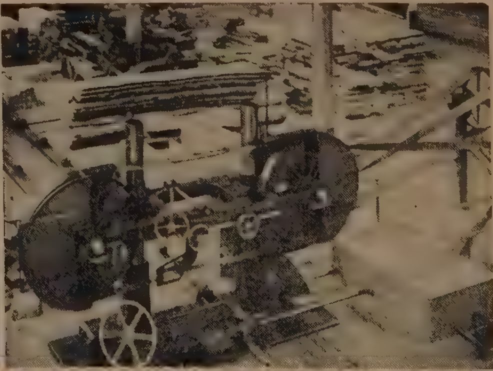
More generally, however, a great circular saw, whirling at an enormous speed, cuts up the logs.



This is the very latest machine for cutting up timber. A row of circular saws is so arranged that the saws, electrically controlled by one man, can be raised or dropped at will. The man sits above the platform and decides which saws to put in action to cut up the plank to the best advantage.



Here a great log is being sawed up into a score of planks at one operation by a series of saws that work in unison up and down.



Another saw used is called a band saw. It is an endless band working over two wheels, the teeth being on one edge of the band.

Typical scenery in the Swiss Alps, showing the Jungfrau, one of the grandest peaks in Europe.

SWITZERLAND

THE standing invitation from Switzerland to the nations of the world is: "Boys and girls, come out to play!" They respond very willingly, thousands and thousands of them, not only from the neighboring countries of Germany, France, Italy, Austria, but through them—for Switzerland has no seacoast—from Holland, Great Britain and America; from Russia, and from almost everywhere else.

We have not far to look to find out the reason why this small country, about half the size of Ireland, is so attractive. The face of Switzerland is very different from the scenery usually before the eyes of dwellers in the cities and villages of our own land. Dazzling white mountains stand out against the bluest of skies; dark forests contrast with bright green meadows down the hillsides, and reach to the shores of wide lakes of ever changing color—purple, blue, green; and into the lakes pour the foaming white rivers.

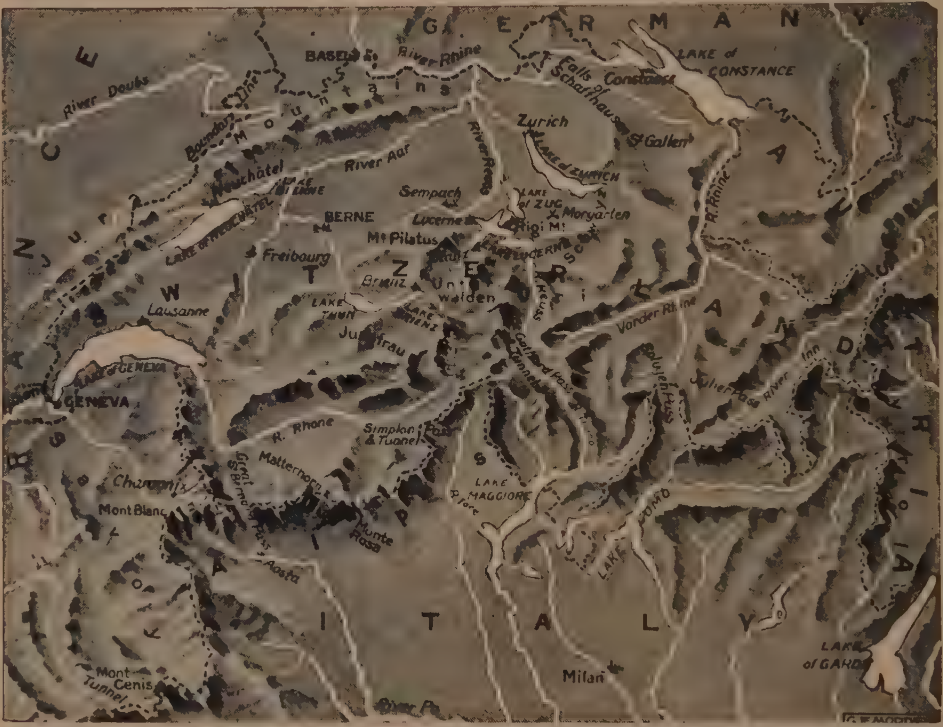
As we look at these beautiful features on the face of Switzerland we realize what an influence the shape of the country has had in shaping its story. Switzerland can well say, "My face is my fortune," not only because its beauties year by year attract travelers who spend in it an enormous amount of money, but because its protecting and invigorating mountains, its fertile valleys and useful lakes have enabled the Swiss to develop into a sturdy, free, industrious nation.

There are to-day rather less than four millions of Swiss—that is, about half the population of London; but they live independent in the midst of powerful neighbors who have tried to annex their country in times past.

First, let us try to get a clear idea of Switzerland itself. The great solid mass of the Alps, the highest land on the Continent, stretches across Europe from the Rhone to the Danube. Its western end is in France, where, south of Lake Geneva, the highest peak of all, Mont Blanc, rises over fifteen thousand feet. Its eastern end is in the Austrian Tyrol. It is the central part of the great highlands that cover more than half of Switzerland with grand ranges of mountains, the tops of many being above the line of perpetual snow. Among others there are Monte Rosa, nearly as high as Mont Blanc; the Matterhorn, near where Switzerland touches Italy; the Jungfrau, and many more about forty or fifty miles north of the frontier.

Valleys separate the ranges and groups of mountains; some a mere cleft in the bare rocks; some wider, and green with grass and gorgeous with wild flowers in spring and summer; others filled with deep, dark forests.

In nearly all the valleys are leaping and dancing streams. High up, the rivers slide and crawl only a few feet in a year, for they are frozen solid. These glaciers, or rivers of ice, some of them twenty miles long, are the chief wonders of the Alps. Their surface is usually very rough and heaped up, like waves suddenly frozen hard. The edges of the ice, seen in the great cracks called crevasses, are of a vivid blue color, as they are also at the end of the glacier, where the warmer air forces the ice king to loose his grip, and the water escapes on its way to the sea.


GERMANY
FRANCE
JURA Mountains
SWITZERLAND
ALPS
ITALY
AUSTRIA
River Doubs
Boundary
BASEL
River Rhine
Falls of Schaffhausen
Constance
LAKE of CONSTANCE
Zurich
LAKE of ZURICH
St Gallen
River Reuss
Neuchâtel
LAKE of NEUCHÂTEL
LAKE of BIENNE
River Aar
Sempach
BERNE
Lucerne
LAKE of ZUG
Morgarten
Rigi Mt
Mt Pilatus
LAKE of LUCERNE
Freibourg
Brienz
Unterwalden
R. Reuss
R. Rhine
Vorder Rhine
Lausanne
LAKE THUN
LAKE BRIENZ
Jungfrau
St Gothard Pass Tunnel
Splugen Pass
Julier Pass
River Inn
LAKE of GENEVA
GENEVA
R. Rhone
Simplon Pass & Tunnel
Matterhorn
Great St Bernard Pass
Chamonix
Mont Blanc
Monte Rosa
Aosta
LAKE MAGGIORE
R. Toce
LAKE COMO
Mont Cenis Tunnel
River Po
Milan
LAKE of GARDA

This picture-map of Switzerland shows us, at a glance, what the country is like. We see it as though looking down from a lofty airship. All over the country rise the great mountain peaks, and in between are the beautiful lakes and winding rivers which radiate in all directions from a central watershed.

Comparatively few of Switzerland's visitors climb over the glaciers and up the highest peaks. It needs strength and endurance to climb in the intense cold, roped to guides, who show the way and cut steps when needed in the ice. But those who do go enjoy it amazingly, so fine is the pure air, so grand are the spacious views and solemn stillness of this white world.

THE GREAT WHITE WORLD BATHED IN GLORIOUS RED AND GOLD

But it is not always white, for at sunrise and sunset in clear weather both sky and snow are bathed in glorious color—rosy red and gold. The stillness, too, is often broken by the thunderous roar of avalanches—masses of snow which slip down the mountain as snow slides off a roof, overwhelming any life that may be below.

Between the High Alps and the plateau of Switzerland there is a beautiful mountainous district which reminds us of Scotland, with its picturesque rocks and pine woods, its heathery moors and mountain lakes. In many of the valleys, and round the lakes of Thun, Brienz and Lucerne, thousands of visitors find villages in which to stay. There are even hotels at the tops of some of these mountains, such as the Pilatus and the Rigi, with wonderful railways which climb up the steep mountainsides from the valley below.

In the plain of Switzerland, which lies between the Alps and the Jura Mountains to the north, are little wooded hills and green slopes, wide fields shaded with fruit trees or richly cultivated with crops of many kinds. The country is covered with towns and villages; everybody is

A FAMOUS CASTLE AND A MIGHTY ALPINE PEAK

The quaint old castle of Chillon, on the Lake of Geneva, has become famous through Byron's poem The Prisoner of Chillon, some lines from which we find among the poems in this book. But, apart from its history, which dates back 1,000 years, the castle would be famous because of the beauty of its surroundings.

The Matterhorn, which we see towering before us in this picture like a mighty obelisk, is the most impressive and inaccessible of all Alpine peaks. It rises 14,837 feet above the sea-level, and was first ascended in 1865, by a party of four Englishmen with three guides. In the descent three of the travelers and a guide were killed, owing to the breaking of a rope. Nestling below is the tiny town of Zermatt.

busy, working either in the fields or in the towns at various manufactures. At the southwest of the plain lies the great Lake of Geneva, so large that it takes a fast steamer two hours to go from one end to the other. Geneva is at the south corner near France. At the northeast of the plain is Lake Constance, whose farther shore is in Germany. Between these two largest lakes are many smaller ones, such as those of Neuchâtel, Bienne, Zürich.

THE RIVER WHICH RUNS DOWN FROM SWITZERLAND INTO FRANCE

All the chief towns of Switzerland lie round the lakes or on the rivers of the plain. These rivers rise within a few miles of each other in a central mountain mass near St. Gothard, and run in different directions. There is the Rhone, rising in a beautiful blue grotto of ice, at the end of the Rhone glacier, and running along a wide and fertile valley to Lake Geneva. It is most interesting to watch the colors of the water of this river as it pours into the lake. Soon after leaving the other end of the lake the Rhone passes into France on its southward journey to the Mediterranean.

The upper Rhine takes a northeasterly course to Lake Constance, and after leaving it at the farther end, makes the wonderful falls at Schaffhausen, and later, turning north at Basle, becomes the German "Father Rhine." The river Ticino rises near the Rhine, and flows down the south slopes of the Alps, leaving Switzerland as it passes through Lake Maggiore to the Po, the great river of north Italy.

The river Inn, on its way to join the Danube, rises not far from the Rhine. Another important Swiss river is the Aar, which rises near the Rhone and flows through Brienz and Thun, then along a winding course to the Rhine. Berne, the capital of Switzerland is on the Aar.

MEN WHO LIVED ON PLATFORMS IN THE LAKES TO ESCAPE FROM BEASTS

In the Museum of Berne there is a deeply interesting model of a settlement built on a lake. It shows us how piles were driven into a soft shore where the water was shallow; how a floor of wood was fastened above the piles; and how, on this floor, the huts were built of wood and hurdles, and roofed with rushes. There was a gangway easily removed to connect with the shore.

As far as we know, the people who lived in these lake-dwellings were the earliest to settle in the country. At any rate, it is believed that their times date back to a thousand years before Christ. Life was very wild then in Central Europe, and it is supposed that men made their homes in this fashion to get out of the way of wild animals and their wild neighbors.

THE FIRE THAT PRESERVED THE STORY OF THE VERY EARLY DAYS

We should know very little about the lives of these folk if their possessions had not been preserved by fire. This sounds strange, but when the flames were consuming these old homes the remains became crusted with charcoal as they fell into the soft bed of the lake beneath, and so they have lasted safe and perfect to these days.

In a large case in the Prehistoric Room in the British Museum labeled "Swiss Lake-Dwellings" we can see the nets, the blackened stones, the raspberry seeds and ears of corn, the fishing boat and hooks, the pottery, small mugs for the children, and tiny bracelets for their arms, among many other things that make this faraway time quite real to us.

The next race of men who made their home in the plain of what we now call Switzerland were the Celts, in many ways like those who lived in Britain. They were very brave and warlike, fond of ornaments and fine armor, and were led by Druid priests. Gradually they were subdued by the all-powerful Romans, who adopted the same plans as they did later in Britain. Fine roads were made across the high passes of the Alps from Italy to the towns established in the plain under Roman rule.

Two chief roads were over the St. Bernard Pass and the Julier Pass—where there are still two milestones of Augustus Cæsar, in whose reign Christ was born. In the museums of all the large towns of Switzerland are many remains of the conquerors of the Helvetians, as they called the chief of the Celtic tribes. Along the beautiful and sheltered shores of Lake Geneva the rich Romans had fine villas, and to this day there are ruins of buildings belonging to the Roman times.

HOW TRIBES WERE BLENDED TOGETHER TO FORM THE SWISS NATION

East Switzerland was never so thoroughly Romanized and subdued as the western part. Hence, when the German tribes succeeded at last in settling in the country—the power of Rome had died

SWISS PEASANTS AT WORK AND PLAY

Living for centuries in their romantic valleys, amid grand and lofty mountains, the Swiss people, although made up of different races, have acquired a national character. They have a buoyant love of liberty, and delight in a life as free as the air. Here we see a Swiss family at play upon one of their grassy slopes.

Swiss women work as hard as the men. Here we see a mother carrying milk from the pasture. She is giving a flower that she has picked to her little child.

The Swiss peasants live in houses built of logs that look as rugged as the mountains on which they stand. Here a peasant is storing fodder for winter.

out—the Alemanni in the northeast entirely absorbed the Celts who lived there, and who had but little power of resistance, and planted a true German people, with their own laws, language, manners and customs. With the Burgundians—also a German tribe, who settled in the southwest—it was different. The new-comers brought fresh vigor into the country, but were influenced by the civilization of the Romanized Celts, and were gradually blended with the earlier settlers, thus forming a new people, the foundation of whose speech was Latin. This was the beginning of a German speech and a Latin speech, which developed into French, being spoken side by side in this little central country. There is no Swiss language to-day. The larger eastern part still speaks German, and the smaller western part speaks French. Where the south border now runs down into Italy the people speak Italian.

For long years the two races were at war with each other; then both were subdued by the Franks, who governed by their officers and counts. The great Charlemagne, whose dominions extended from Spain to Hungary, from Denmark to Rome, spent much time in Switzerland.

THE IRISHMAN WHO FOUNDED A SWISS ABBEY AND FORMED A LIBRARY

Many great monasteries and abbeys were founded or made more important in Charlemagne's day. One was that of St. Gall, founded by an Irish missionary, in which learning was carried on, and valuable books were written and collected during the years of warfare and trouble which distracted the country. At St. Gall, now one of the chief industrial towns of Switzerland, many of these old manuscripts are still to be seen.

When Charlemagne's dominions were divided, the east and west divisions of what is now Switzerland fell apart again, boundaries and rulers were constantly changing, and the people had a desperate struggle to keep any of the old rights so dear to the hearts of all nations of German descent. Powerful churchmen, and great families who had secured large grants of land, all managed to destroy the liberties of those who lived on the soil.

When the German emperors took possession of the country they governed by nobles, who became more and more powerful as the power of the Holy Roman Empire declined.

It was the growth of free towns that helped the people to resist their lords. These towns were walled in, and they had charters which gave them freedom to trade and make money, like the free towns of Germany. Fribourg and Berne date from the twelfth century, and in their fine old buildings and handsome fountains we have many reminders of the far past.

In the next century comes the rise of the Hapsburg family, from among a crowd of nobles on Swiss soil, all trying by conquest, marriage, purchase of lands or unjust takings to get the lead. We have read on page 3963 of Rudolph of Hapsburg, who rose to be German emperor. In Switzerland he waged war with Berne, forced lands from nobles and abbots, and seized farms and estates; and his heavy hand was felt all over the country. Perhaps because it was so heavy the people resolved to bear it no longer. Anyway, the love of freedom seemed to revive, and their determination raised an enduring obstacle to the rule of the Hapsburgs.

One of the tributaries which make the Aar so large and full when it joins the Rhine is the Reuss. Leaping down the rough sides of the St. Gothard, it passes on through a long, narrow lake with many branching armlets, and out at the farther end with rapid swing, past the beautiful old town of Lucerne.

THE FIERCE FIGHT FOR SWISS FREEDOM WHICH TOOK PLACE ROUND A LAKE

It was round the shores of the Lake of Lucerne—sometimes called the Lake of the Four Cantons, because four cantons, or counties, share its shores—that the brilliant struggle for Swiss independence was carried on in the thirteenth and fourteenth centuries against the tyranny of the Hapsburgs.

Three out of the four cantons formed a league. They were Schwyz, Unterwalden and Uri; it is from Schwyz that the name Switzerland comes. The men who lived in these three famous cantons were descendants of the freedom-loving Alemanni, and for them the lake was a common outlet and rallying-place. Their towering mountains and valleys, hidden away from the rest of the world, had kept them distinct and self-reliant, and their bodies were hardy from the perpetual struggle to make their living under difficulties; their spirits were bold and fear-

HIGH PEAKS OF WONDERFUL MOUNTAINS

Although these mighty snow mountains of the Alps seem so unfriendly to man, and so far away, it is only the tops of them that are uninhabitable. For lower down their vast and tree-covered sides there are many villages, and in the cozy valleys between the foothills of the Alps there are bright and happy towns, merry with the noisy waters that run in rapid rivers from the melting snow of the glaciers.

The Alps are, indeed, like so many terrible giants with their white heads in the clouds, but in their laps they let men build their towns and live in peace, though now and then they let slip dreaded avalanches which may sweep away a village that has built itself too near the white heads of these giant mountains. It is wonderful to think that an African army, with thousands of horses and elephants, led by Hannibal, crossed the Alps more than 2,000 years ago. Napoleon also took an army across the Alps.

less from constant contact with danger, which each had to meet for himself. Added to this was the intense love of country which makes brave men dare anything. When once we see this glorious country, its towering mountains, its frowning rocks, its widespread forests, its lovely green slopes, its orchards and meadows, and the unspeakable beauty of the lake with its soft blue distances and deep shadows, it is easy to understand the patriotism of the three forest cantons.

HOW THREE MEN MET IN THE MOUNTAINS BY NIGHT TO SAVE THEIR COUNTRY

Many of the romantic stories that have been handed down through the centuries about these times are now considered untrue; but they are so firmly imbedded in the country's story, and illustrate in such a graphic way the spirit of the times when the union of the states was taking place against a powerful enemy, that we still love them. One of the stories tells how, on a green meadow above the Uri branch of the lake, three patriots who had suffered greatly from Hapsburg rule met in the still, dark nights to talk over their wrongs, and vowed to free their country from oppressors. Friends joined them, till the band became thirty-three. As these men raised their right hands to heaven, making covenant together, "One for all, and all for one," the sun shot its first cheering rays over the mountain-tops, and seemed to promise success. The three men of Ruetli (Ruetli meaning the "secret meadow") have long been national heroes of the Swiss.

The romantic story of William Tell, who shot the apple from his son's head, is told on page 7217. All over Switzerland are statues and pictures to illustrate the act. One of the most beautiful poems of Schiller has spread the story or legend of William Tell all over the world.

A WHIRLWIND RUSHING DOWN ON THE FRIGHTENED AUSTRIANS

In 1315 the spirit of resistance to the Hapsburgs led to the great battle of Morgarten, and this victory began a series of successes which for two centuries increased the feeling of union. At Morgarten the large Austrian army was overwhelmed and destroyed in a narrow pass by the mountaineers, few in number. They lay in wait on the heights, and at the right moment hurled down on their foes stones, rocks and trunks of trees. Then the main body of the men of Schwyz and Uri rushed like a whirlwind down the hill on the terrified Austrians.

Some seventy years later the Austrians were again defeated. The battle of Sempach is famous for the bravery of Arnold von Winkelried, who gathered the spears of the foe to his breast. There is a fine monument to Winkelried at Stans, in Unterwalden.

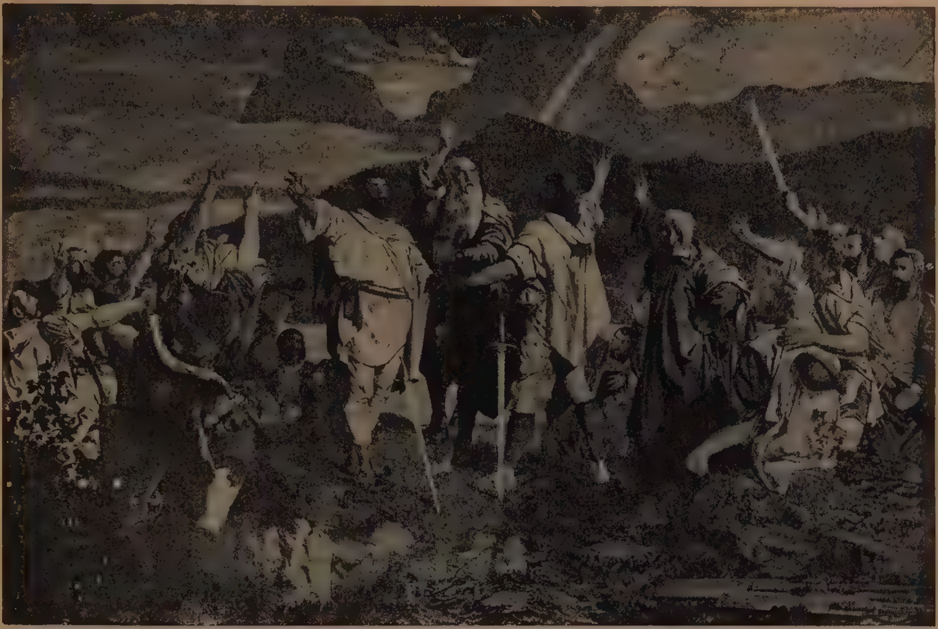
Toward the middle of the fifteenth century there were eight cantons joined in union, and such was their power that they succeeded in getting the better, not only of the Austrian Hapsburgs, but also of the Duke of Burgundy, who harassed the west side of Switzerland nearest to France. At last the unity and bravery of the Swiss succeeded in making their independence secure, though in name they were attached to Austria till the Peace of Westphalia, in 1648, which ended the Thirty Years' War.

THE OLD SWISS REFORMERS AND THEIR ENGLISH FRIENDS

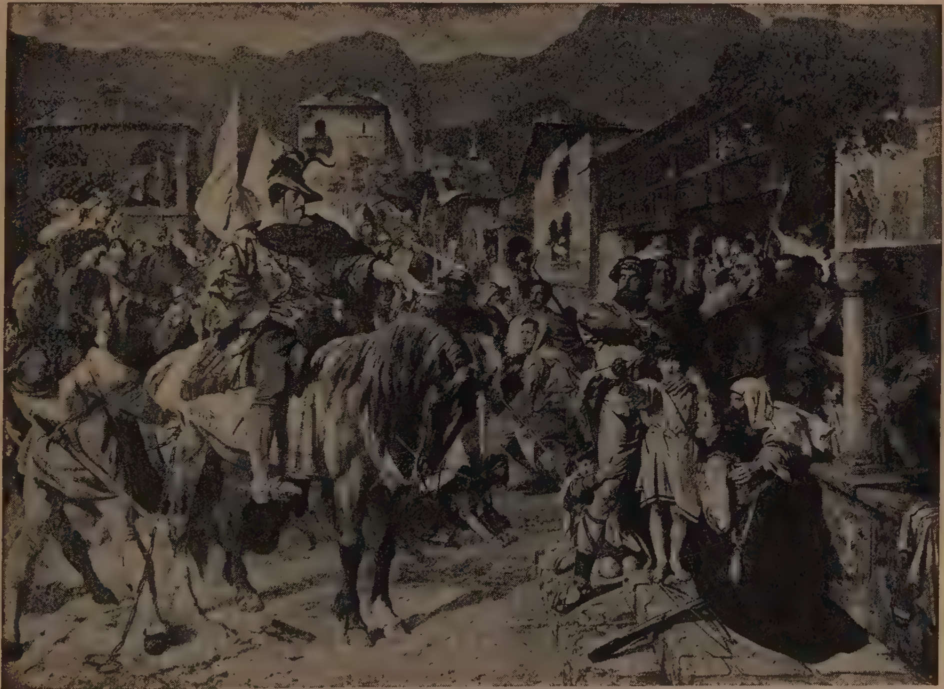
Switzerland had its own Reformation about the beginning of the sixteenth century. Large numbers of the people listened to the teaching of the reformer Zwingli and others, and left the Church of Rome. Ulrich Zwingli, who was born on New Year's Day in 1484 and died in the autumn of 1531, gained his power over the people by his bold preaching. He introduced the doctrines of the Reformation before they were advanced by Luther. Eventually war arose between the Roman Catholics of the forest cantons and the followers of Zwingli in Zürich, and in 1531, at the battle of Cappel, where the men of Zürich numbered only one to four, Zwingli himself was slain. Unhappily, bitter feelings between the Roman Catholic and the Protestant cantons brought about long civil wars before religious freedom was gained.

At Zürich are to be seen many letters from eminent people of Reformation times, which show how much intercourse and friendship there was between the English and Swiss in those days. Especially interesting to children are those of Lady Jane Grey, when a studious girl of fourteen, to one of the Swiss preachers. She translated part of one of his books into Greek for a Christmas present to her father, and asks his advice how best to study Hebrew. At the last sad moment in the Tower, when at the block itself, the poor girl took off her gloves and asked

HEROES OF THE SWISS FIGHT FOR FREEDOM



There is a story that early in the fourteenth century the oppression of the Hapsburg rulers had become so unbearable to the Swiss that three brave patriots determined to resist. They called together a few trusty countrymen, and in a lonely meadow at Ruetli, with none looking down upon them save God, they took a solemn oath to preserve the freedom of their nation. Others say this happened earlier.



Legend says that one of the Swiss patriots who took the oath at Ruetli to fight for freedom was William Tell, whose story we read on page 7217. He was compelled by a brutal governor to shoot an apple placed on his son's head, and the rejoicings of the people when Tell succeeded in transfixing the apple without hurting the boy were very great. Whether or not the story is true, it shows the spirit of the Swiss people.

that they should be sent to her Swiss friends. Letters from Queen Elizabeth, too, are among those at Zürich, encouraging the Swiss cantons and cities in their struggle for liberty.

Switzerland shared in the progress of those times when people began to care for study and art. The little country has reason to be proud of its writers and scholars, and the artists who have left such beautiful work behind for later times in the stained glass, wonderful carvings, and painted tiles still to be seen. Refugees from religious persecution in other countries did much to foster trade and industries, especially the weaving of linen and silk. But, despite all this prosperity, a time of decline set in.

The deeds of daring and courage which led to the rise of the Swiss people spread their military fame over Europe, and Swiss soldiers were eagerly sought after, and hired for pay to fight in other armies, especially in France. This was bad for the independent nation.

THE CRY FOR HUMAN FREEDOM THAT RANG THROUGH THE MOUNTAIN LAND

Again, the influence of the despotic Louis XIV spread over Switzerland as it did over Germany, and the spirit of absolute rule led to the peasants' being ground down and deprived of their rights, while the governing classes indulged in luxury. There were many grievous risings, and the country was in a sad plight when the cry of the French Revolution, *Liberty, Equality, Fraternity,* spread, echoing over the mountains and plain of Switzerland.

When Napoleon turned Europe upside down, Switzerland could not escape. French armies, often fiercely resisted, passed through the cities, across the plain, over the snowy mountains at will. Napoleon made grand roads—that over the Simplon Pass is a wonder of the world—as Cæsar had done centuries before, and seized Swiss money and treasures. Then Napoleon turned the country into the Helvetic Republic, under his own eye. The Swiss naturally hated the pounding of the cantons into one state, and the old spirit of bravery and resistance flashed out again and again.

But it was not till after the Battle of the Nations at Leipzig that the weight of Napoleon's hand was removed, and the Swiss were far from satisfied with the arrangements made at the Congress of Vienna. Many changes had to be lived through in the years of the nineteenth century before the twenty-two cantons settled down to a federal union, perhaps the freest and most representative in the world.

The Swiss believe that education alone makes free, and their arrangements for teaching are such that they reach to the poorest child in the remotest valley, thus fitting all to take part in the universal voting by which the country is governed. Pestalozzi was one of the great leaders in improving education, and his influence has spread far beyond Switzerland. John Henry Pestalozzi thought out the principles of education with care and originality, and put them directly into practice himself; but he was a thoroughly unpractical man in the ordinary affairs of life, and his management of a school always collapsed because he could not organize it in a businesslike way. None the less, he attracted wide attention by his methods of teaching, and they are still studied with interest. Born at Zürich, he lived from 1746 to 1827. Great attention is given also to teaching trades of all kinds, and since the introduction of machinery Swiss industries have increased marvelously. Water power in the leaping torrents from the mountains is turned to use in saw-mills and other factories. Every village, even the most remote, has electricity for lighting and power, and the telephone is available for all. Early last century in the cloisters of the famous St. Gall Monastery arose the hum of spinning, and in Zürich and the neighborhood began the cotton and embroidery manufactures now so famous all over the world. The production of silk goods holds its own at Zürich and Basle, and at Neuchâtel and Geneva are made watches and musical boxes.

Berne, the capital of the country, has a population of about 100,000 people, and is the fourth town in size. Zürich, with 200,000, is a great industrial and educational centre. Basle, in the north, 140,000, is the distributing railway centre of the country. Geneva, in the south, has about 140,000 inhabitants, many of these being foreigners. Other towns with over 40,000 people are: St. Gall, 70,000; Lausanne, an educational centre, 68,000; Winterthur, an engineering town, 50,000; and Lucerne, 45,000.

All round the borders of Switzerland trains now bring in the coal and raw

SWISS TOWNS AT THE BENDS OF THE RIVERS

Zürich is the largest and most important town in Switzerland, and many fine buildings have been erected in recent years. It is the centre of Swiss silk manufacture, and Zwingli, the Swiss reformer, lived there.

Berne, the Swiss capital, is a delightful town, with a university, a fine museum, and also the Swiss House of Assembly. It is situated at a bend of the river Aar, and commands a fine view of the Alps.

Lucerne, the centre for Swiss tourists, is a curious mixture of ancient and modern, for, while retaining its old walls and watch-towers, it is well equipped with modern improvements, such as electric lighting.

Interlaken, one of the most beautiful of all the beautiful spots in Switzerland, commands a good view of the famous Jungfrau peak, 13,669 feet high, the white mountain seen in the middle of this picture.

Photos, Photochrome Co. and Wehrli Aktien Gesellschaft, Zürich.

materials needed by this industrious country, and carry away its finished work. Switzerland has also to obtain from abroad much grain, as well as coffee, rice, eggs and other foods.

RAILWAYS UNDER THE MOUNTAINS AND ABOVE THE CLOUDS

The lines which pass into Italy depend on the wonderful tunnels that have been made through the masses of the Alps. The Mont Cenis Tunnel is in the French Alps. The St. Gothard Tunnel is rather longer, and the Simplon Tunnel is twelve and a quarter miles long. The Arlberg Tunnel connects northern Switzerland with Tyrol. The engineering of all these Alpine railways is most wonderful, not only in the matter of tunnels, where workmen starting from the two ends meet in the middle of the mountain, but also in the loop railways, and the numberless mountain lines that climb over passes, and up steep inclines to heights often above the clouds.

It is delightful to get a peep into the life of the mountain folk, to see them taking charge of the herds of cows with their tinkling bells; making cheeses in the little huts; carrying down an immense weight of them to sell in the markets below. It is touching to notice how every little scrap of land is made the most of, and how the little bits of hay are collected in a net and carried to the loft to be stored for winter. For, as the cold and snow come on, the cattle are driven down from the heights when there is nothing for them to eat; with much lowing and jingling of bells they make their way down.

HOW THE CROSS OF SWITZERLAND BECAME THE SYMBOL OF MERCY

A large trade in condensed milk is carried on in Switzerland, and the milk of Swiss cows is also used in chocolate-making. In the winter many of the mountaineers carve little animals, chiefly bears, like those to be seen in the pit at Berne. They make also little model chalets such as they live in themselves, with stones on the roof, to keep it on in the stormy winds. They are very clever in making flowers, and other delicate things, out of ivory.

It was at Geneva that the Red Cross was formed in 1861, the principle being accepted by all nations gathered there that nations at war shall never fire on ambulances or hospitals, with nurses and doctors who are caring for the wounded, under a Red Cross flag. That is the flag of Geneva. The flag of all Switzerland is a white cross on a red ground.

During the World War Switzerland was kind to all countries alike, and without favor helped the wounded and prisoners; and when the League of Nations was formed, to prevent wars and promote justice between nation and nation, Geneva was made the headquarters of the League.

Each of the cantons has local government of a kind devised by itself, but all the cantons join in a general government for the Confederation. This federal government regulates war, peace and treaties; the army, railway, post, coinage, and weights and measures; bankruptcy, patents, precautions against epidemics, public works on a national scale, and largely education. Other public affairs are treated as local.

THE DEMOCRATIC GOVERNMENT OF THE LITTLE ALPINE NATION

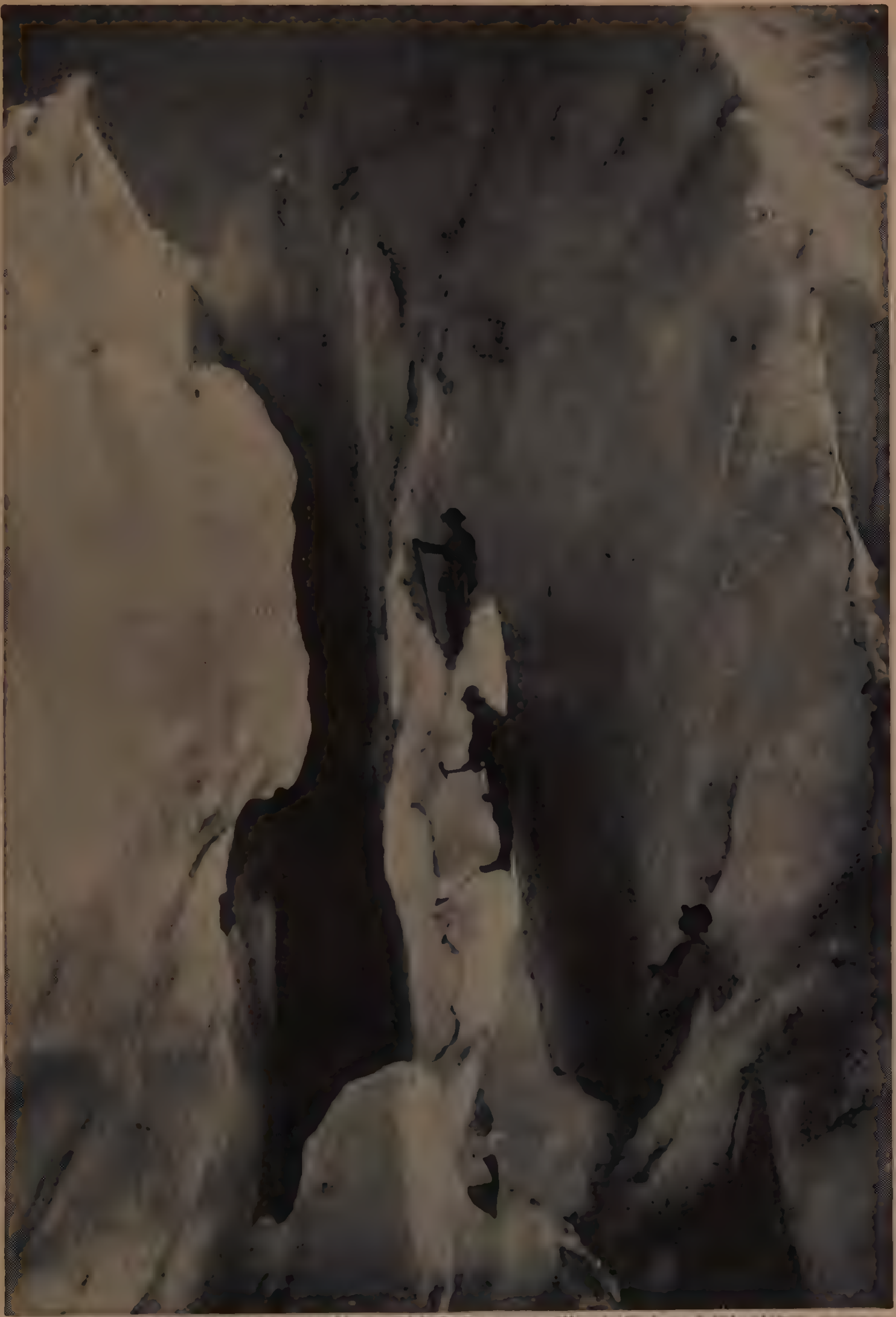
The Swiss Parliament consists of two chambers, a State Council of 44 members, two from each canton, and a National Council of 198 members, one for every 20,000 of the population. Elections take place every three years. Every man has a vote in his twenty-first year, and any voter may be elected. No other country in the world is as thoroughly democratic as Switzerland.

The electors can introduce legislation into the Parliament directly if 50,000 of them demand it. They can also object to any law passed by the Government by sending in a petition of 30,000 citizens. Then a direct vote of the whole nation must be taken, and if there is a majority of the electors and also a majority of the cantons against the law, it may be vetoed or amended. This supervision of laws by the people direct is called the referendum.

The executive authority is a council of seven members elected for three years by the Parliament. Its members may not hold any other office or do any other business. The President and Vice-President are elected by the whole Parliament for one year. These supreme officials are usually business men who have won general confidence, and the spirit of this most democratic of all governments is one of modest simplicity with business efficiency. It may often happen that the President of Switzerland is to be found opening the door of his small house to a caller, or receiving visitors in his shop or his office.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6083.

CROSSING A CREVICE IN THE ALPS



There are not many heights in the world to which daring men will not climb, and this picture shows us the dangerous things that mountain-climbers do. The men are roped together, and, on their way up the Alps, are gazing into the vast depths of a crack in the mountainside which they are about to cross. Sheer above them rise the snow-clad sides of a great white mountain, the top of which they hope to reach. Many men lose their lives in climbing to these immense heights and crossing over these great depths.

The photographs on these pages are by G. P. Abraham, Keswick.

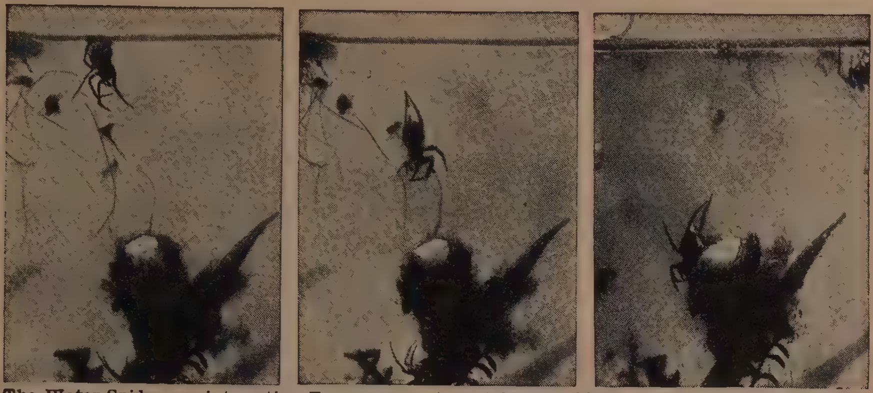
"WILL YOU WALK INTO MY PARLOR?"

The spider looks out upon the world and sees the fly approaching.

The spider wraps up the fly in a web blanket and returns to the middle of the web.

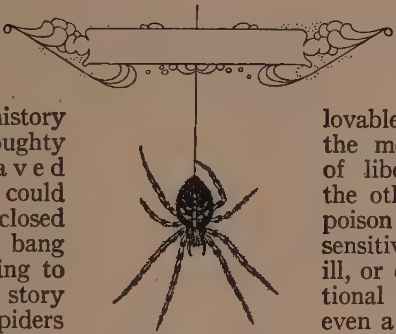
After ten minutes the spider visits his prey, cuts the threads and takes it back.

The spider carries his victim to his den, where he banquets at leisure.



The Water Spider, an interesting European creature, takes a bubble of air to its home in a pool.

LITTLE MANY-LEGS



IN the old days when those heroes of romance and chivalry of whom we read in history were still living, a doughty warrior who had braved every peril which he could imagine would have closed this chapter with a bang and have crept trembling to bed. For our present story is about scorpions and spiders and some other things of ill-fame even in our own day. In former times their reputation was worse. Our forefathers down to Shakespeare's time, and far later, believed in dragons and fire-breathing basilisks. They thought that as scorpions ate venomous things to increase the power of their own venom, so these fabulous creatures lunched on scorpions to add to the intensity of their own evil poisons.

The Old Testament teems with references to scorpions. Later, terrible tales were told. There were scorpions that stung young girls to death on sight, and caused the lingering death of women. Others ate men. Still others had feathers and flew afar to their mischief. Some scorpions had such a hatred toward men that they would mount to the ceiling and hang, one from another, five or six deep, merely for the evil delight of inflicting a mortal wound.

The truth is that scorpions, spiders and their allies, while not exactly lovable creatures, are, for the most part, the victims of libel. The one stings, the other bites. Both have poison which may make a sensitive and nervous victim ill, or even kill in an exceptional case. But a shock, even a suggestion, may have that result in a rare instance, where neither scorpion nor spider is within a hundred miles.

Scorpions have their unpleasant aspect, undoubtedly, but it is wrong and foolish to overstate the case against them. They, like the spiders, feed upon insects and other small creatures, taking the good—according to man's ideas—with the bad, but having no desire to harm man.

If the Order were nearly as fatal to human fortunes as these old beliefs represented, there would be no human family in existence. Scorpions are almost as old as the hills. Their lungs are quite different from the lungs of mammals, and resemble in some ways the gills of a fish.

The arrangement of these organs is suggested by their name—lung-books. They communicate with the atmosphere through narrow openings, and are composed of a number of thin projections, like the leaves of a book. The blood circulates through these, comes in contact with the air, and so is purified. Therefore the scorpion and its allies are able to live in the atmosphere as we are.

Like all the arachnids, to which they belong, scorpions have no neck. The head is really part of the thorax. Two pairs of appendages spring from the head. There is a small pincer on each side of the mouth called the chelicera. Behind these is a formidable pair of pincer claws which serve to grasp prey. They then act as jaws to tear and rend it in readiness for the mouth, which sucks the juices from the mangled fragments of a victim. Four pairs of clawed legs arise from the hinder part of the chest. Insects have only three such pairs.

A QUEER OLD BELIEF ABOUT THE DAINTY FORGET-ME-NOT

Whenever we look on the dainty forget-me-not let us recall its old-time name in England—scorpion grass. It was anciently believed there that if people used scorpion grass they would have no need to fear the sting of a scorpion. And truly they were right, as far as England was concerned, even if they did not call scorpion grass to their aid, for, as far as we know, there never were any scorpions in that country. Scorpions are fairly widely scattered about the earth, and abound in Southern Europe as well as in southern United States.

Temperature, rather than light, is the main requisite. Though scorpions have three or four pairs of eyes, they see but dimly, and come out to hunt only at dusk. Touch and smell are their guiding instincts, and both faculties reside, apparently, in the great pincer-like claws which we call the pedipalps. Nothing more than two or three inches away is visible to a scorpion. Experiment has shown that the creature will run partly over a cockroach without discovering it till its sensitive feelers touch it. Then it will draw back and eat the booty just discovered.

The great lobster-like claws are carried in front of the head. They are not used for walking, nor do they have any share in the digging of the sandy home, for this is the work of the legs, with the tail to sweep away the accumulated débris. The pedipalps, then, sense and grip objects. If the prey is small, the claws do the whole business of slaughter. A larger victim, however, is firmly grasped and held, while the tail is curved over the back and the sting brought down and introduced. After that there is no resistance: the little monster eats his meal.

THE TERRIBLE LITTLE CREATURE WHICH RUNS AWAY FROM LIGHT

Generally scorpions avoid human beings, and they run anywhere for seclusion from light. They delight in creeping into beds, shoes and clothes, so that when we get into a bed or put on our garments in the tropics we may be invading the place which a scorpion has chosen in which to hide away from the daylight.

Then, if we are not frightened by the threat of his angry pincers, he applies his poison-oozing sting, causing violent pain and sickness. There are nervous weaklings who die with the bite of a small snake or a big spider. The same type of temperament may collapse under the shock of a scorpion bite. Hence the indictment of which the poor scorpion can never prove himself guiltless.

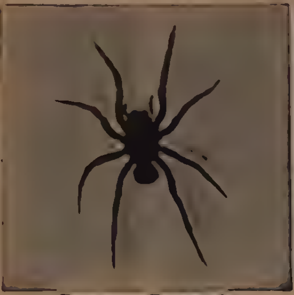
The natural prey of the scorpion consists of spiders, insects that live on the ground, and, from time to time, small frogs and even tiny mice. Agile, elusive creatures all these, it will be noticed, for an assailant which does not readily detect prey at a distance. True, but the creatures caught by the scorpion are not all keener of sight than their captor. If the day's hunting proves unsuccessful, the scorpion can bear it. Northern kinds fast during the winter season, though alive and alert as the wintering crayfish.

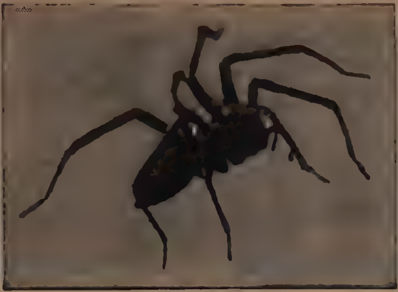
THE OLD NATURALIST SPENT MONTHS WATCHING SCORPIONS

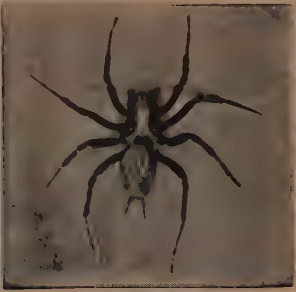
One item of diet has to be added. It is scorpion! The courting season often ends in tragedy. Before the wedding the males woo most ardently. The naturalist Henri Fabre devoted months to watching them in France, and we owe much of our knowledge to his writings. The little male seizes a buxom female greatly his superior in size and power. With their hideous faces brought into contact, they exchange what a scorpion poet might dignify with the name of a kiss.

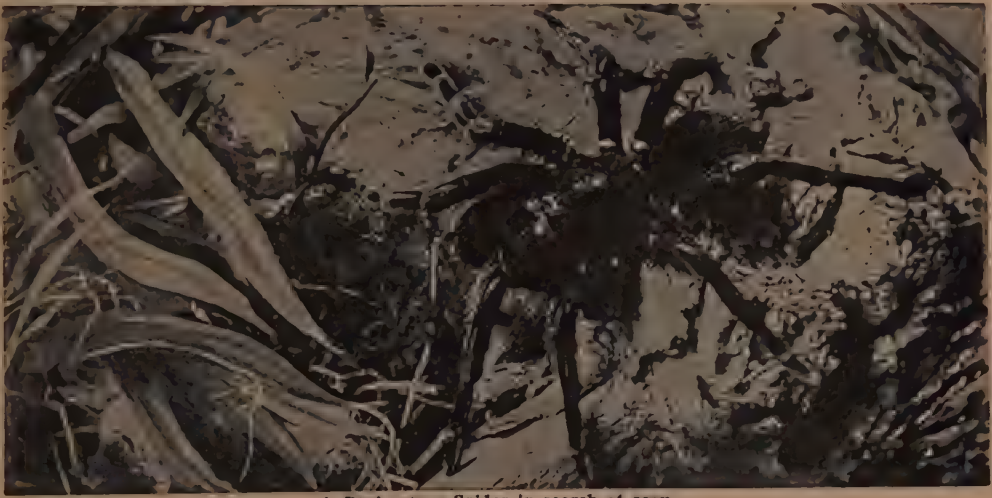
Then off they prance, the male grasping the female's claws. He walks backward, leading or gently dragging his mate after him. They may promenade for hours, even for days, in this way, till finally he induces her to approach a burrow which he has made.

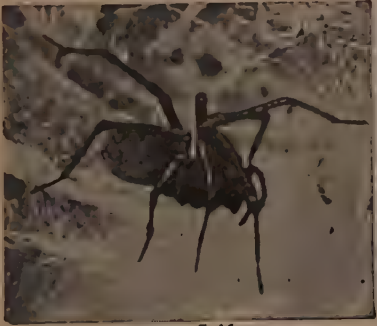
A LITTLE COMPANY OF SPIDERS

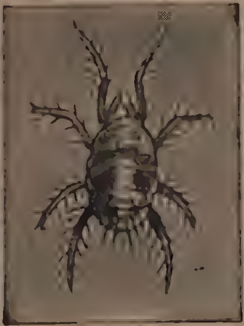

European Tarantula.

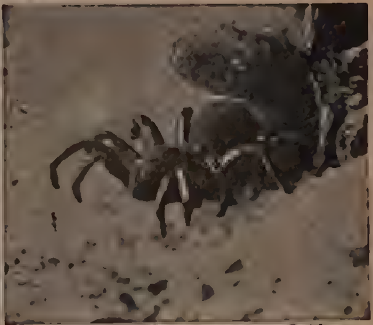

Garden Spider.


Wolf Spider.

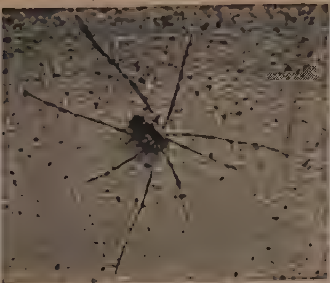

A Bird-eating Spider in search of prey.

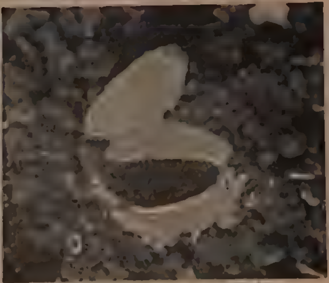

House Spider.


Red Mite.


A South American Trap-door Spider.

The home of the House Spider.


Common Harvestman.


Nest of a Trap-door Spider.

The pictures on these pages are by Mrs. M. H. Crawford, Messrs. Berridge, Collins, Johnson, Ward and others.

THE CANNIBAL BRIDE WHO DINES ON HER BRIDEGROOM

But the result is never in doubt. Once the female accepts the home and fortune presented by the male the end is in sight. She enters, settles down, and dines—on her bridegroom. But he is not stung to death—merely eaten. Scorpion poison is not harmful to scorpions. There is an old tale that the scorpion sometimes stings itself to death. Nonsense!

Eight inches is the greatest length to which scorpions are known to attain. Three inches is about the average for adults outside of the tropics. The tales of their eating men and other victims of bulk are as ridiculous as that they are winged and feathered. Even so, they have sufficient terrors for nervous folk who find them sharing their socks.

THE WONDERFUL SILK OF THE WORLD'S FIRST SPINNERS

What has the Spider world to show in comparison with the petty villainies of the scorpions? Spiders have their poison, though not a sting; they are as voracious, in their way, as the scorpions in theirs. But though they come boldly into our daily lives, they do not inspire the fear among people in general which undying tradition has created in connection with their stinging cousins.

Really we ought to approach the spiders with more of marveling than of repulsion. They were among the world's first aeronauts, first builders, first engineers, first spinners and weavers. How they originally succeeded in converting food into a natural glue which on entering the air instantly becomes silk, we shall never be able to find out.

But there it is. A man of the wilds faced by a wide, steep chasm is defeated unless he can climb like a goat. Even goats cannot scale precipices. A spider is our master in the matter. He cocks up his spinnerets and squeezes out a number of tiny jets of material looking to the eye like a dark-colored gum from a mistletoe berry. As they emerge, the jets unite into one splendid strand of silk, stronger, in proportion to size and weight, than the finest steel ever compounded.

The strand grows and grows under the effort of the spider. It floats off into the air and has its gummy end caught on a distant projection. Across this tight rope, this natural bridge, spun from its own body, the spider proceeds in triumph to the conquest of a new world.

THE AGE-OLD MYSTERY OF THE BABY SPIDER'S LONG FAST

That is the magic of the adult; the baby spider has a feat at command not less astonishing. In some species the mother attends to her eggs and to her babies when they are born, and carries the little things about with her. They ride on her back, guarded, transported, snugly housed; but fed—never! They reside on her body, fasting week after week for seven or eight months, without one particle of food or one drop of moisture.

How do they sustain life, strength and growth under such extraordinary hardships? The active sport and play in which they seem to indulge consume energy; their growth demands more; yet they take in no fuel to replenish their engines of life. Here is a mystery which is unsolved to this day. But the time comes when their cycle of baby life is run. Their call comes to quit the mother. She lets them go without regret, as a hen beats away the chickens which she has cherished for a month or more. She would eat them if they tarried longer.

Their guardian angel now becomes a consuming dragon to the little spiders. They fly from her, not actually, but in such a manner as to suggest the comparison. They climb to the nearest height, to the top of hedge or tree or wall; they spin out their little webs as the chasm-crosser spins his. The silk floats out far from the unfed little bodies, and as the wind catches and hauls it into the air the spiders, securely attached to it, rise with it, soar and float away—aeronauts without engines, living balloons.

THE SPIDER-LIKE CREATURES LIVING IN THE OCEAN DEPTHS

That all spiders spin and all have poison is a safe rule; yet there are spider-like creatures in the deep seas, and in the shallow waters near the coast, which, if they are poisonous, certainly do not spin. Silk web would be of no use in such turbulent wastes, it would seem. But are they spiders? The class which we are now considering are technically known as the *Pycnogonida* and are not true spiders. They possess one pair of limbs in excess of the number proper to spiders. The extra pair is devoted, in the male, to carrying the eggs laid by the female.

This class ranges from our own coasts through all seas and all depths. Various species are variously colored. Some are scarlet; some match the corals; some are green in accordance with seaweeds; some transparent; some that live in the deep sea are of a deep purplish red. Some have the gift of swimming; others merely crawl, down in the depths, where the weight of water is such as to crush man-made inventions flat and to reduce vessels of glass to finest powder.

THE LITTLE SILKEN DOOR WHICH KEEPS THE SEA AT BAY

One sea-spider, however, does spin. This is a member of the family of spiders which cover our country hedges with web. The sea species is called *Agalena desis*. It is a master builder of the ocean, making its home in crevices of rocks and coral reefs. At low tide it runs out into the open to feast on small crustacea, and, some say, tiny fish. With the return of the tide it retreats to its home and walls itself up with silk. It shuts out the sea with a doorway of massed gossamer. It can defy the sea whose advances mocked Canute, and when the ocean ebbs afresh it lowers its flimsy portcullis and browses again in its little jungle on the rocks.

Another spider lives in fresh-water pools in Europe. This one is the creator of the diving bell. Something similar, in steel and iron, we used to employ for our submarine engineering. But air and silk are the only materials here. Anchoring itself by a strand of silk to a water plant, the spider marches down the stem and spins a tent of silk beneath the surface.

Then it climbs up, turns the hinder end of its bristly little body into the air and collects a bubble of air in it. Then it dives with the bubble imprisoned between the bristles and its legs, and releases the life-giving supply in its tent. The little home swells, as there is air within it. There the spider sleeps and lays her eggs, rears her babies, and lives the life of an enchanted princess in a fairy cave in the crystal depths.

THE SPLENDID RAFT OF LEAVES BUILT BY A WATER SPIDER

Still keeping to the water, there are spiders which make boats and sail, apparently in search of food, although the "boats" may be rather accidental and the spider may have no definite idea in mind. They weave a silken chain to bind together little leaves into a raft. On this they sail, to plunge every now and then into the water, or rather to walk on it. Water has a film on its surface. Let those who doubt it watch a Raft Spider running over it, secure as a man on ski crossing a snow-field.

Let us turn again, however, to the spinners proper, and pause before our great Garden Spider. Its web is not to be surpassed by any wonder of the tropical spiders. It is made in about an hour. At the beginning of it the spider is a harmless little vagabond; at the end of it she has an estate hung up in the air, a home, a fortress, a snare for the unwary. It is all fabricated from her own small body. Of course she may not rush straight through her task, but may dawdle and dally and then go to work again; but give her one open space, with suitable anchorage, and she can achieve a feat of natural magic.

The first necessity is to fix the beams of her chamber. She may either allow a strand to be blown so that its end may catch a convenient point and form a line; or she may fix an end herself, then drop or crawl down, trailing out silk behind her, till she has reached the point she desires. Here she makes a little dab with the hinder end of the body, and so fixes the thread to where she would have it. She makes, first, two beams roughly parallel, in this way. Then she connects her parallels, and the scaffold of the circular net is there.

THE LINES OF WEB WHICH ARE LIKE THE SPOKES OF A WHEEL

Next, she has to form the radial lines which, all passing through the centre, are like the spokes of a wheel. She builds up the hub as she goes, for we can see her continually adding and strengthening there, putting in new silk and eating up the earlier deposit, or adding fresh material to that already in position.

As she builds she makes her structure her pathway. Having spun one thread, she walks along it to connect the next, and fastens each to the outer beams with a dab of silk. There may be eighteen, twenty or more of these, but they are all quite smooth, not sticky. Then she begins to form the spiral, the great central section of the snare. The building of this is a splendid example of speed, method and prudent care. She walks round and round the skeleton web, across the threads, producing web as she goes, and at each spoke, before attaching the new strand, she gives it a tug with a claw.

The little line stretches, and when it is at its extreme tension she applies it to the spoke, and seems to seal it there with a touch of the spinnerets. Then she is off to the next spoke. The first two or three turns round the growing web simply furnish extra support for the structure, and they, too, are free from stickiness. Now, however, she pours out web which is decidedly sticky, and may remove the smooth spiral.

The sticky substance is pulled out from the spinnerets, and it seems as though the exact amount necessary to reach from one spoke to the next is withdrawn each time, for there is always the same little pull for tightening, always an exact join when she applies the line to a spoke.

THOUSANDS OF GUMMY GLOBULES COVER THE WEB OF A SPIDER

So she goes on, working from the circumference toward the centre, though she may not go all the way around every time. All the spokes are linked up till the web is complete, with hundreds of joinings. Yet it is all one, like so much rubber fabric united when fluid. The work of this great hour is ended. But, you will say, she still has to dot the web with those thousands and tens of thousands of gummy globules. No; she has really finished, and the globules are already forming without special application on her part.

The silk for the snare part of the web issues as a sticky stream. Although it apparently solidifies into silk, the surface does not dry, but retains its stickiness. With the pull of the web this fluid ceases to be an unbroken coating; it parts, as it were, running into little beads, close together, but regularly grouped.

We see, then, that the spider produces different solutions—one for the framework which is not sticky, and one which is like a living gum, fitted to grip and hold any insect which may brush against it. She knows she has these different reservoirs of precious material, and she knows instinctively on which to draw.

The web is one of the most wonderful things in nature. The spider works by instinct, but she adapts her home to varying conditions, throwing out buttresses here to withstand an unexpected strain; adding a stout guy-rope there to pull the web out of the way of a descending drip of water; spinning a backstay where the sway of a shrub threatens to break down the fabric.

HOW THE GARDEN SPIDER MENDS HER BROKEN WEB

It is interesting to watch her when the wind has cast a heavy leaf into the web. She rushes to the breach, cuts the damaged web with her jaws, works till the leaf is free, and drops to the ground. Then she mends the broken web. Into it fly all manner of insects, midges by the score, flies, bluebottles, moths. At the least touch she is alert. She does not see well. She picks up a strand in one of her talons and pulls on it. It is her method of securing directional signals, as our airmen and navigators say. Vibrations travel along her line, and she races up or down the web as though wearing seven-league boots.

If the victim is a fly, she gives it a fatal bite in the neck. She may then settle down to suck it dry, or if she is busy or not hungry, she spins a web all over it, and hangs it there, like a tiny ham on a farm ceiling, waiting till she has appetite.

In the case of a wasp or other stinging creature, she is cautious. She can kill the wasp if she takes it at a disadvantage, but the wasp can kill her in fair fight. So she stands afar off and casts out her web like a little man with a tiny lasso. She nooses the wasp from a distance, runs round and round till she has bound it head and limbs, body and sting. Then she creeps up and makes the fatal wound.

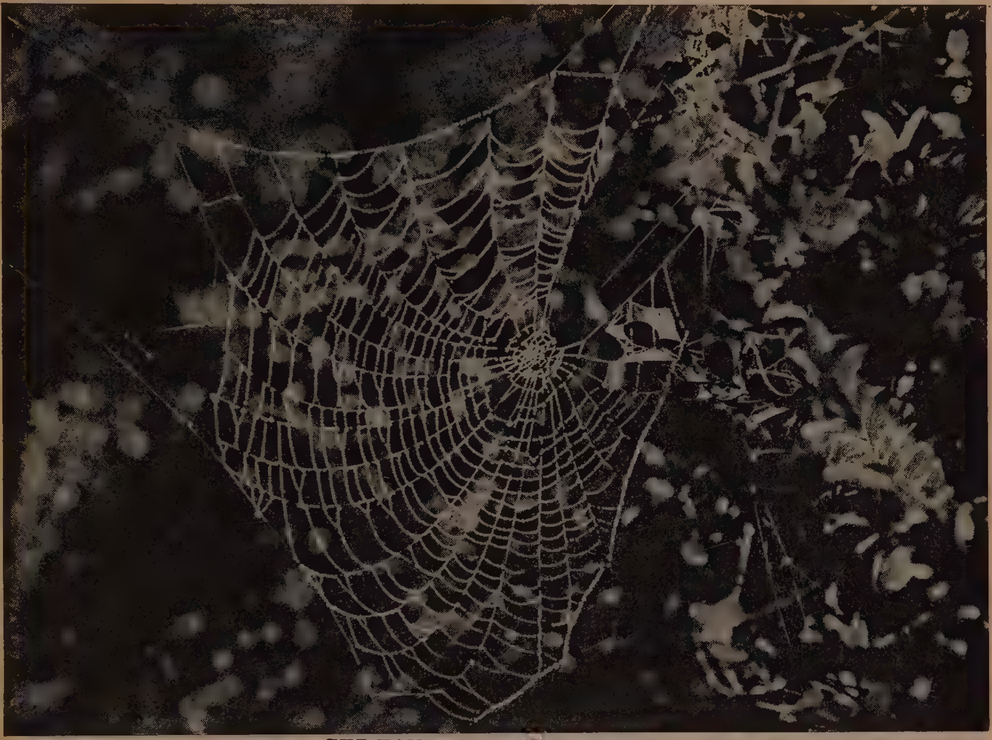
Six spinnerets, fed from about six hundred glands, equip her for her tasks, and one spider has been known to put forth a hundred yards of silk without a pause. There are many other great web-spinners scattered about the earth. The common House Spider is no mean artist, much as tidy housekeepers detest it.

THE LITTLE PARLOR INTO WHICH THE SPIDER INVITED THE FLY

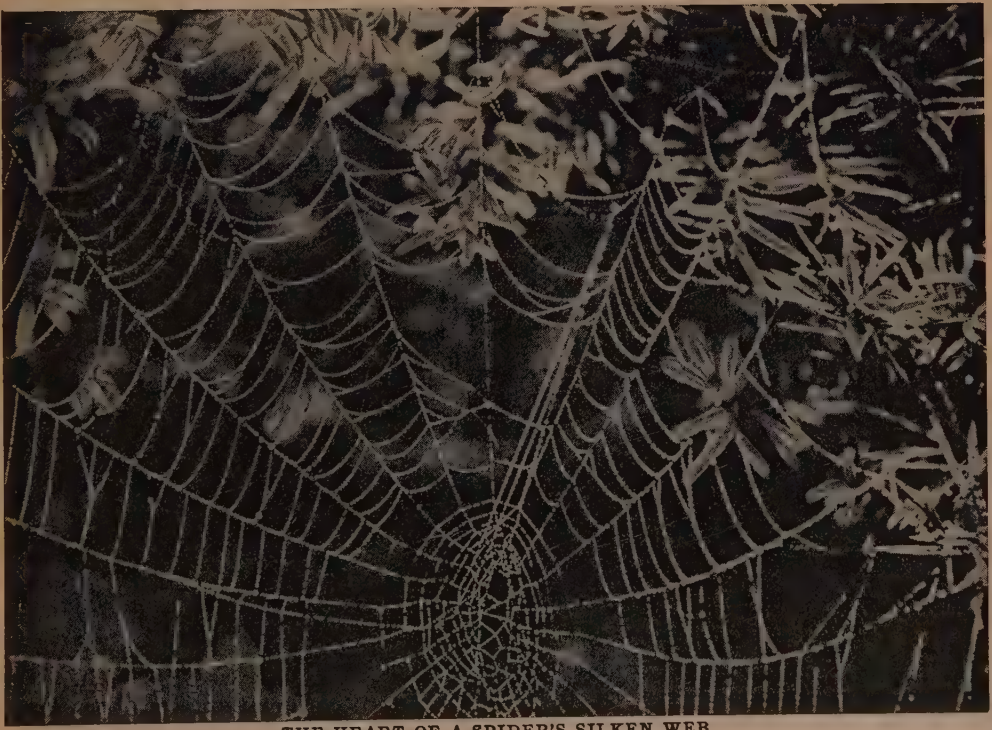
There is a true parlor behind the sheet of web, into which the fly was invited to walk. It has a way in and another way out, to afford escape from danger, and, to crown all, it is weighted with grains of sand or other heavy particles to give it stability. The web of the house spider is a masterly work, but we must give our space to the feats of the trap-door spiders.

These are numerous in species and methods. Some make their traps in

A WONDERFUL HOME MADE OF SILK



THE HOME OF A GARDEN SPIDER



THE HEART OF A SPIDER'S SILKEN WEB

trees, the majority in the ground. Here is a marvel of instinctive ingenuity. The spider digs a hole in the ground to a depth of several inches, and lines the interior with silk. Then it covers the opening with a lid of silk, but bites this through all the way round, except at one spot. There the silk is left undisturbed and so forms a true hinge to the door.

Next, the spider comes out and with infinite industry collects particles of earth and distributes these over the silken flap; then binds them in place with another layer of silk, adding more layers of earth and silk until the builder thinks it is strong enough. After that the little master craftsman decorates the whole with moss and other tiny pieces of vegetation till it exactly matches its surroundings. One may look directly at the door and not see it. When besieged in this little fortress by an enemy the spider clings to the under-side of the door with its legs and pulls with all its strength to resist the attempt to open the door.

THE HAIRY GIANT AND THE BIRDS IT CATCHES IN ITS SNARE

These Trap-door Spiders belong to the same class as the dreaded bird-eating spiders. They are the giants of the Order—huge hairy brutes six or seven inches across the legs.

They live in trees or in earth-burrows, and weave exceedingly strong webs. In these they are said to catch birds and tiny mammals, such as mice. Their bite is excessively poisonous, and when they have made the fatal bite, they suck the blood of bird or beast as our garden spider sucks the blood of a bluebottle. Their brittle hair also causes intense irritation of the skin.

Another powerful spider is the Tarantula, so named after a spider which, first found near Taranto, in Italy, was supposed to produce dancing mania in its human victim. Tarantism was a common malady of the Middle Ages. Probably it was an epidemic of emotional hysteria, a nervous affection. At any rate, people afflicted believed themselves to have been bitten by the Tarantula spider.

They danced with frenzy until they fell exhausted. Music was supposed to be a relief to their wrought-up feelings, so various melodies sprang into existence for the benefit of sufferers. From them we get the Tarantella of modern music.

THE DEADLY EFFECT OF THE BITE OF THE TARANTULA

How deadly the bite of the spider was we do not know, but it is certain that so-called Tarantula spiders in South America have bitten people and that people have died, but whether from fright, from fear, or actually from the spiders' poison, cannot be determined. Fabre found that bees and wasps die at once from the bite, that a sparrow survives but three days, and that a healthy mole expires thirty-six hours after being bitten.

Our common Wolf Spiders are much like Tarantulas. These, though they trail a strand of web after them and make silken retreats in the earth, are active hunters in the open, and stalk their prey like cats, finally leaping on them with unerring accuracy. There are some four thousand species of these spiders, and few are better known than the active jumping species common to sunny walls and sandy banks. Many of these spiders carry their sacks of eggs about with them. The young spiders resemble their parents.

Another interesting member is the Field Spider, which makes a small tubular nest in the crevices of a wall, or in the soil, and runs a labyrinth of strands to surrounding objects, to catch unwary passers-by, as we snare wild animals in a corral. More grotesque are the crab spiders, frequently seen in flowers and interesting because by their sidelong gait they imitate crabs.

There are a few so-called spiders which are not true spiders at all. There is, for instance, the Harvestman, having a small body with long legs, and being more nearly related to mites and ticks than to the spider. The so-called Red Spider, which bleeds leaves in the conservatory and many precious cultivated crops in the open, is really a mite, but not to be confused with the little red-haired mite whose six-legged larvæ, called harvest mites, attack our flesh and cause itching and discomfort.

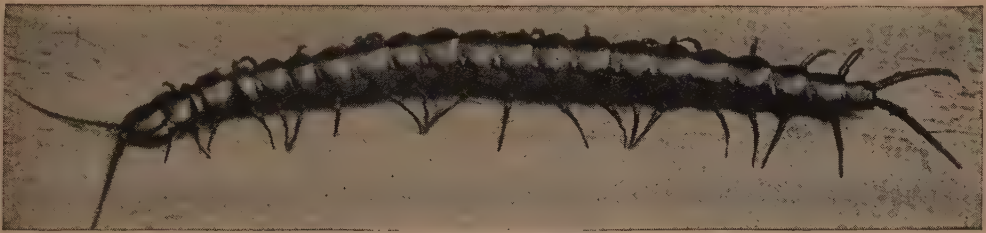
Mites are enormously abundant in numbers and species. Many species do not measure more than one-hundredth of an inch, yet they are extremely harmful to ourselves, our animals, birds and vegetation. They all bore and suck juice, whether it be sap or blood. They infest all kinds of life. They cause horrible diseases in man and animals, mange in dogs and horses.

At least eight species of Ticks attach themselves to cattle by their powerful beaks and suck their blood. One transmits the dreaded Texas fever in cattle. For this reason cattle shipped from an infected section are "dipped" in a vat of oil or other fluid to destroy the pest. Some mites infest young chickens or pigeons and hinder their growth. Other parasites commonly found on sheep and which are usually called ticks are not ticks at all, but in reality wingless flies. It would perhaps avoid confusion if they were more generally called by another common name, that of Ked. While the sheep ked has only six legs, the tick, when fully grown, has eight.

A Millipede.

A Scorpion of Central Africa.

A Centipede.



A West Indian Centipede.

Domestic Mite.

Bulb Mites.

False Scorpion.

Currant-bud Mites.

Brown Tick.

There is one tick found in areas where cattle are bred called the Paralysis Tick. In certain parts of Montana this is affected by small parasites which it passes on to man, causing the disease known as Rocky Mountain fever, or spotted fever. In British Columbia we have records of these ticks causing paralysis in men and animals. Paralysis is caused by the female tick when she is feeding fast; if she is sucking blood slowly paralysis does not occur.

The species is found over the greater part of southeastern British Columbia and in the adjacent portion of southern Alberta. It appears as an adult early in the spring and attaches itself to the skin of large wild and domesticated animals and man. After feeding for about seven days the female drops off into the ground and lays about four thousand eggs, which hatch into minute six-legged larval ticks. The larval tick climbs on to grass- or flower-stems, and, when the opportunity offers, gets on to rabbits, squirrels, chipmunks or field-mice. After four days the tick drops off to the ground, molts, and some thirty-eight days later emerges as an eight-legged middle-sized tick. It attaches itself again to the same kind of small animals for about seven days, molts once more, and in about ninety days emerges as an adult tick.

Cattle and horses may carry the tick, but mostly sheep. The commonest tick on horses is the Moose Tick, which, if present in sufficient numbers, will weaken an animal through loss of blood. An arsenical dip is good against it, or greasy preparations which block the breathing pores of the tick, located near its fourth pair of legs. Farmers examining the heavy-wooled parts of a sheep find a number of dead ticks—killed by the lanolin in the wool.

Other mites and ticks penetrate human hair and skin. The skin disease known as the "itch" is caused by a mite. In the South a tiny red mite called the Chigoe, or Chigger, burrows into the skin and causes much discomfort, but is easily killed by salty fat. Ravenous as they are in the presence of food supplies, these mites and ticks can fast perhaps longer than any other known form of life.

To justify in full the title of our present chapter, we have yet to come to the true "many-legs" though all that we have so far considered have more legs than the true insects. Now, however, we come to creatures in which Nature seems to have made a habit, when not otherwise engaged, of adding segments and legs, as if for experiment. The result is seen in the centipedes and the millipedes.

THE POISONOUS LITTLE CREATURES WITH MANY PAIRS OF LEGS

The Centipedes are fierce flesh-eating creatures which lurk beneath stones, bark of trees, or other hiding-places, and stir out only in the dark to hunt and slay. They vary in build, some having but fifteen segments and as many pairs of legs; some having about a hundred. The number of paired legs is always an odd one. In the centipede, for example, the number of pairs would be 99 or 101, never 98 or 100.

The tropical centipede can paralyze a rabbit instantly by a touch of its poison. The thought is unpleasant, but so are most of the things with which the centipede grapples—for our good. The same Hand which gave the rose its thorn, the nettle its sting, the cactus its appalling defenses, the snake and devilfish their venom, decreed this lethal fluid for the centipede, and enabled him to administer an anæsthetic to his victim.

THE MILLIPEDE THAT EATS UP THE ROOTS OF THE CROPS

The Millipede is innocent of poison. Long-bodied and oval, he has more legs than most of us would count. His feeble, filament-like limbs are admirably adapted for the millipede's wriggles through the earth, where he gnaws the roots of our crops. His purpose in the scheme of the world's economy seems to be to destroy rubbish and decaying vegetation. If we plant our vegetation in land which has been his family's from ancient time, then we invite him to appease his appetite.

It is curious that the poisonous centipede and the harmless millipede should arise from the same stock, but they are said to have done so. Some of them can twist and turn with an activity which would do credit to an eel, but others, smaller and less powerful, have borrowed the habit of the trilobite, and, like the wood-louse and the hedgehog, can coil up into the semblance of a pill.

Creepy, crawly things are the subjects of this chapter. They were greatly dreaded by the people who came before us. They inherited their fears and the notions on which they were based. The ancients exalted the crab and the scorpion to the dignity of the stars, and there, in the zodiac, they are to-day. Can we wonder that men and women who firmly believed that their lives were governed by special stars should look with fear on creatures whose form they thought they espied and named up in the gleaming heavens?

We preserve the zodiac with its portrait gallery, but no longer are we afraid of the creatures in it. In that we are more enlightened than our ancestors. We know more of the nature of the creatures themselves than Shakespeare and Bacon knew. For that reason we have still a wholesome dread of scorpion and poisonous spider, but the dread is a rational one. It does not make us fear that a scorpion will suddenly take wing and breathe down fire on us, or that a spider will turn from the devouring of snakes to devour us.

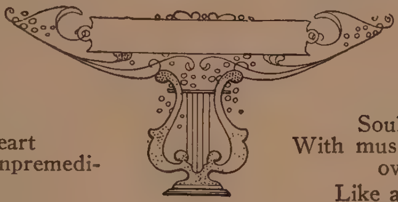
A spider, said our old wise men, is a worm of the air; and that, in the language of that day, meant a snake. Spiders are everywhere, but, after all, we know that every spider in the world is the potential enemy of some insect that might injure man's purse or person, although most of its victims could not harm us and might even help us. As for the mites and the ticks, we can think of no benefit that we derive from them, though perhaps a few species do feed upon scale insects which attack our crops.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6063.

A GREAT POEM BY SHELLEY

MANY poets have addressed odes to the skylark and have endeavored to describe its joyous song. No one has succeeded better than Percy Bysshe Shelley in his well-known ode called The Skylark. The poem has become a great favorite, not only because of the beauty of its metre and the images it brings to the mind's eye, but also because of the thoughts and feelings which the bird and its song inspire in the poet. The Skylark is one of the shorter masterpieces of English literature.

TO A SKYLARK



HAIL to thee, blithe spirit!
Bird thou never wert,
That from heaven, or near it,
Pourest thy full heart
In profuse strains of unpremeditated art.

Higher still and higher
From the earth thou springest
Like a cloud of fire;
The blue deep thou wingest,
And singing still dost soar, and soaring ever singest.

In the golden lightning
Of the sunken sun
O'er which clouds are brightening,
Thou dost float and run,
Like an unbodied joy whose race is just begun.

The pale purple even
Melts around thy flight;
Like a star of heaven
In the broad daylight,
Thou art unseen, but yet I hear thy shrill delight:

Keen as are the arrows
Of that silver sphere,
Whose intense lamp narrows
In the white dawn clear
Until we hardly see, we feel that it is there.

All the earth and air
With thy voice is loud,
As, when night is bare,
From one lonely cloud
The moon rains out her beams, and heaven is overflowed.

What thou art we know not;
What is most like thee?
From rainbow clouds there flow not
Drops so bright to see
As from thy presence showers a rain of melody.

Like a poet hidden
In the light of thought,
Singing hymns unbidden,
Till the world is wrought
To sympathy with hopes and fears it heeded not:

Like a high-born maiden
In a palace tower,
Soothing her love-laden
Soul in secret hour
With music sweet as love, which overflows her bower:

Like a glow-worm golden
In a dell of dew,
Scattering unbeholden
Its aerial hue
Among the flowers and grass, which screen it from the view:

Like a rose embowered
In its own green leaves,
By warm winds deflowered,
Till the scent it gives
Makes faint with too much sweet these heavy wingèd thieves.

Sound of vernal showers
On the twinkling grass,
Rain-awakened flowers,
All that ever was
Joyous, and clear, and fresh, thy music doth surpass.

Teach us, sprite or bird,
What sweet thoughts are thine:
I have never heard
Praise of love or wine
That panted forth a flood of rapture so divine.

Chorus hymeneal
Or triumphant chaunt
Matched with thine, would be all
But an empty vaunt—
A thing wherein we feel there is some hidden want.

What objects are the fountains
Of thy happy strain?
What fields, or waves, or mountains?
What shapes of sky or plain?
What love of thine own kind? What ignorance of pain?

With thy clear keen joyance
Languor cannot be:
Shadow of annoyance
Never came near thee:
Thou lovest; but ne'er knew love's sad satiety.

Waking or asleep
Thou of death must deem
Things more true and deep
Than we mortals dream,
Or how could thy notes flow in such a crystal stream?

We look before and after
And pine for what is not:
Our sincerest laughter
With some pain is fraught:
Our sweetest songs are those that tell of saddest thought.

Yet if we could scorn
Hate, and pride, and fear;
If we were things born
Not to shed a tear,
I know not how thy joy we ever should come near.

Better than all measures
Of delightful sound,
Better than all treasures
That in books are found,
Thy skill to poet were, thou scorner of the ground!

Teach me half the gladness
That thy brain must know,
Such harmonious madness
From my lips would flow
The world should listen then, as I am listening now!

HOLYROOD

In this imaginative poem by Will H. Ogilvie we have a good test of our knowledge of Scottish history. Holyrood is perhaps the most historic building in Scotland; it is full of memories of the kings and queens who reigned at Edinburgh. If our readers have studied carefully the story of Scotland they will not have difficulty in understanding the allusions in this poem.

THE moon held court in Holyrood last night—ten thousand stars
By ancient tower and archway climbed and kissed the window-bars.
The night wind knelt upon the hill, the crouching lion lay
With shoulder to the capital and blind eyes to the bay.

The moon held court in Holyrood, and as she entered in,
On damask fringe and tapestry the spider ceased to spin.
The slow moon slipped across the floor and bowed a queenly head
To greet the train that passed her by—a thousand sleepless dead.

She drifted down the storied hall and touched with spread white wings
The gallery of a hundred dead; the corridor of kings.
She smiled upon a rebel prince, and stretched white hands to shrive
The gallant men, the peerless maids, that danced in "Forty-five."

She crossed a sleeping-chamber, hung with trappings rich and rare,
And kissed them softly one by one; it was a queen lay there.
She heard the lute notes rise and fall, she watched the dagger sped,
While underneath her trembling wings the brown stain turned to red.

The moon held court in Holyrood, and from the northern tower
She looked along the High Street sad at heart for Scotland's flower,
And looking saw a rider pass, pale-faced and battle-worn
Beneath the drooping Flodden flag, all red and slashed and torn!

The moon passed out of Holyrood, white-lipped to open sky;
The night wind whimpered on the crags to see the ghosts go by,
And stately, silent, sorrowful, the lonely lion lay
Gaunt shoulder to the capital and blind eyes to the bay.

THE PILGRIM FATHERS

This fine poem by Felicia Hemans describes an opening chapter in the history of the American nation. The Pilgrim Fathers, as they were called, much dissatisfied with the rule of James I of England, went to Holland. After a sojourn there and a long voyage across the sea, they landed at Plymouth, Massachusetts, on December 21, 1620, from their little ship the Mayflower, and founded the colony which later grew powerful enough to join the twelve others in asserting and winning their independence.

THE breaking waves dashed high
On a stern and rock-bound coast,
And the woods, against a stormy sky,
Their giant branches tossed;

And the heavy night hung dark
The hills and water o'er,
When a band of exiles moored their bark
On the wild New England shore.

Not as the conqueror comes,
They, the true-hearted, came:
Not with the roll of the stirring drums,
And the trumpet that sings of fame;

Not as the flying come,
In silence and in fear,—
They shook the depths of the desert's gloom
With their hymns of lofty cheer.

Amidst the storm they sang,
And the stars heard, and the sea;
And the sounding aisles of the dim woods rang
To the anthem of the free!

The ocean-eagle soared
From his nest by the white waves' foam,
And the rocking pines of the forest roared;
This was their welcome home!

There were men with hoary hair
Amidst that pilgrim-band:
Why had they come to wither there,
Away from their childhood's land?

There was woman's fearless eye,
Lit by her deep love's truth;
There was manhood's brow, serenely high,
And the fiery heart of youth.

What sought they thus afar?
Bright jewels of the mine?
The wealth of seas, the spoils of war?—
They sought a faith's pure shrine!

Ay, call it holy ground,
The soil where first they trod!
They have left unstained what there they found—
Freedom to worship God!

THE BELLS

Edgar Allan Poe is one of the most remarkable poets America has produced, and, with the exception of Walt Whitman, the most individual genius in American poetry. He was born in Boston on January 19, 1809, and died in Baltimore on October 17, 1849, after an unsettled and disastrous life. No modern poet or writer of fiction has excelled him in weird and "uncanny" imaginings. He is also a great master of word melody. In the following famous poem, which has long been popular as a recitation by reason of its dramatic force, one can see how the verse steadily increases in its measure of music and changes in character from the jingling sound of the light sledge-bells to the far-resounding noise of the great city bells ringing in the still night.

HEAR the sledges with the bells—
Silver bells!
What a world of merriment their melody foretells!
How they tinkle, tinkle, tinkle,
In the icy air of night!
While the stars that oversprinkle
All the heavens seem to twinkle
With a crystalline delight;
Keeping time, time, time,
In a sort of Runic rhyme,
To the tintinnabulation that so musically swells
From the bells, bells, bells, bells,
Bells, bells, bells—
From the jingling and the tinkling of the bells.

Hear the mellow wedding bells,
Golden bells!
What a world of happiness their harmony foretells!
Through the balmy air of night
How they ring out their delight!—
From the molten golden notes,
And all in tune,
What a liquid ditty floats
To the turtle-dove that listens, while she gloats
On the moon!
Oh, from out the sounding cells,
What a gush of euphony voluminously wells!
How it swells,
How it dwells
On the Future; how it tells
Of the rapture that impels
To the swinging and the ringing
Of the bells, bells, bells,
Of the bells, bells, bells, bells,
Bells, bells, bells—
To the rhyming and the chiming of the bells!

Hear the loud alarum bells—
Brazen bells!
What a tale of terror now, their turbulency tells;
In the startled air of night
How they scream out their affright!
Too much horrified to speak,
They can only shriek, shriek,
Out of tune,
In the clamorous appealing to the mercy of the fire,
In the mad expostulation with the deaf and frantic fire.
Leaping higher, higher, higher,
With a desperate desire,
And a resolute endeavor
Now—now to sit or never,
By the side of the pale-faced moon.
Oh, the bells, bells, bells!
What a tale their tenor tells
Of Despair!
How they clang and crash and roar!
What a horror they outpour
On the bosom of the palpitating air!
Yet the air it fully knows,
By the twanging,
And the clanging,
How the danger ebbs and flows;
Yet the air distinctly tells,
In the jangling,
And the wrangling,
How the danger sinks and swells,
By the sinking or the swelling in the anger of the bells—
Of the bells—
Of the bells, bells, bells, bells,
Bells, bells, bells—
In the clamor and the clangor of the bells!

Hear the tolling of the bells—
Iron bells!
What a world of solemn thought their melody compels!
In the silence of the night,
How we shiver with affright
At the melancholy menace of their tone;
For every sound that floats
From the rust within their throats
Is a groan.
And the people—ah, the people—
They that dwell up in the steeple,
All alone,
And who tolling, tolling, tolling,
In that muffled monotone,
Feel a glory in the rolling
On the human heart a stone—
They are neither man nor woman—
They are neither brute nor human,
They are Ghouls:
And their king it is who tolls;
And he rolls, rolls, rolls,
Rolls
A pæan from the bells!
And his merry bosom swells
With the pæan from the bells!
And he dances and he yells;
Keeping time, time, time,
In a sort of Runic rhyme,
To the throbbing of the bells—
Of the bells, bells, bells—
To the sobbing of the bells:
Keeping time, time, time,
As he knells, knells, knells,
In a happy Runic rhyme,
To the rolling of the bells—
Of the bells, bells, bells—
To the tolling of the bells,
Of the bells, bells, bells, bells—
Bells, bells, bells—
To the moaning and the groaning of the bells.

THE DAY IS COMING

This poem by William Morris was written in his character of reformer, a character that also produced several prose sketches of a bettered world. It is taken from The Pilgrims of Hope and Chants for Socialists, in Longmans Pocket Library, by permission of the author's trustees.

COME hither, lads, and hearken, for a tale there is to tell
Of the wonderful days a-coming, when all shall be better than well.

And the tale shall be told of a country, a land in the midst of the sea,
And the folk shall call it England in the days that are going to be.

There more than one in a thousand in the days that are yet to come
Shall have some hope of the morrow, some joy of the ancient home.

Then a man shall work and bethink him, and rejoice in the deeds of his hand,
Nor yet come home in the even too faint and weary to stand.

Men in that time a-coming shall work and have no fear
For to-morrow's lack of earning and the hunger-wolf anear.

I tell you this for a wonder, that no man shall then be glad
Of his fellow's fall and mishap to snatch at the work he had.

For that which the worker winneth shall then be his indeed,
Nor shall half be reaped for nothing by him that sowed no seed.

O strange new wonderful justice! But for whom shall we gather the gain?
For ourselves and for each of our fellows, and no hand shall labour in vain.

Then all Mine and all Thine shall be Ours, and no more shall any man crave
For riches that serve for nothing but to fetter a friend for a slave.

And what wealth then shall be left us when none shall gather gold
To buy his friend in the market, and pinch and pine the sold?

Nay, what save the lovely city and the little house on the hill,
And the wastes and the woodland beauty, and the happy fields we till;

And the homes of ancient stories, the tombs of the mighty dead;
And the wise men seeking out marvels, and the poet's teeming head;

And the painter's hand of wonder; and the marvellous fiddle-bow,
And the banded choirs of music; all those that do and know.

For all these shall be ours and all men's, nor shall any lack a share
Of the toil and the gain of living in the days when the world grows fair.

THE SHEPHERDESS *

The poems of Alice Meynell are noted for their delicacy, and some of her poems for children are among the sweetest of their kind.

SHE walks—the lady of my delight—
A shepherdess of sheep.
Her flocks are thoughts. She keeps them white;
She guards them from the steep.
She feeds them on the fragrant height,
And folds them in for sleep.

She roams maternal hills and bright,
Dark valleys safe and deep.
Into that tender breast at night
The chastest stars may peep.
She walks—the lady of my delight—
A shepherdess of sheep.

She holds her little thoughts in sight,
Though gay they run and leap.
She is so circumspect and right;
She has her soul to keep.
She walks—the lady of my delight—
A shepherdess of sheep.

TO A BUTTERFLY

This little poem was composed by William Wordsworth at Grasmere in England, on March 14, 1802, and it referred to the poet's childhood days spent in the town of Cockermouth with his beloved sister Dorothy. "Emmeline" is a fanciful name used by the poet instead of his sister's real name. Dorothy used to chase the butterflies with her brother, and it was because she told him later of her fear of brushing the dust off their wings that he wrote these verses.

STAY near me—do not take thy flight!
A little longer stay in sight!
Much converse do I find in thee,
Historian of my infancy!
Float near me; do not yet depart!
Dead times revive in thee:
Thou bring'st, gay creature as thou art,
A solemn image to my heart,
My father's family!

Oh, pleasant, pleasant were the days,
The time when, in our childish plays,
My sister Emmeline and I
Together chased the butterfly!
A very hunter did I rush
Upon the prey—with leaps and springs
I followed on from break to bush,
But she, God love her, feared to brush
The dust from off its wings.

BORROWING

SOME of your hurts you have cured,
And the sharpest you still have survived,
But what torments of grief you endured
From evils which never arrived!
—RALPH WALDO EMERSON.

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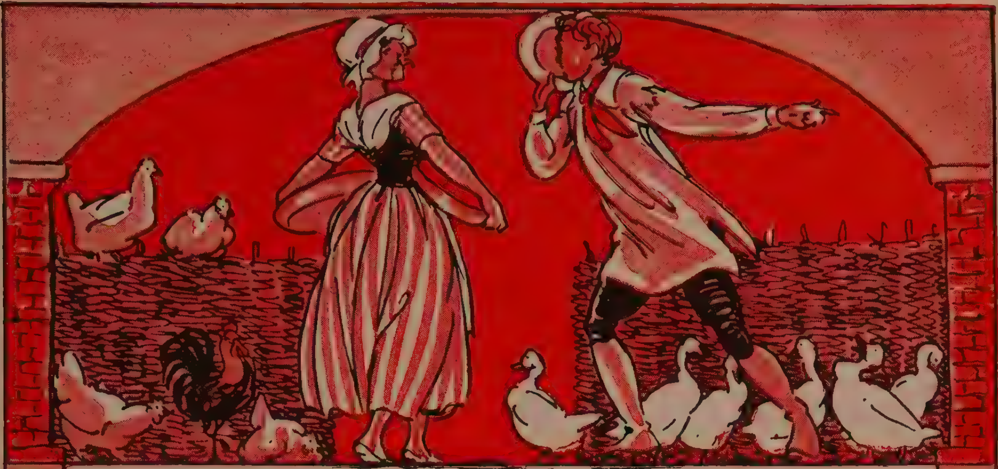
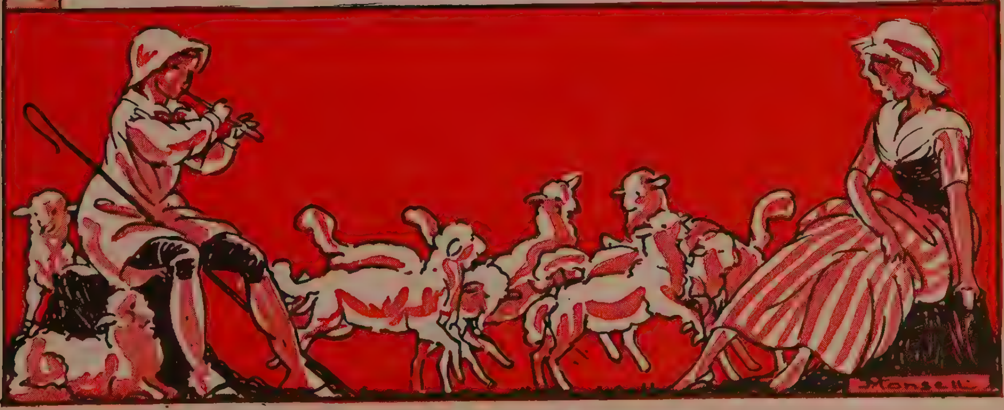
THE FARMER'S BOY

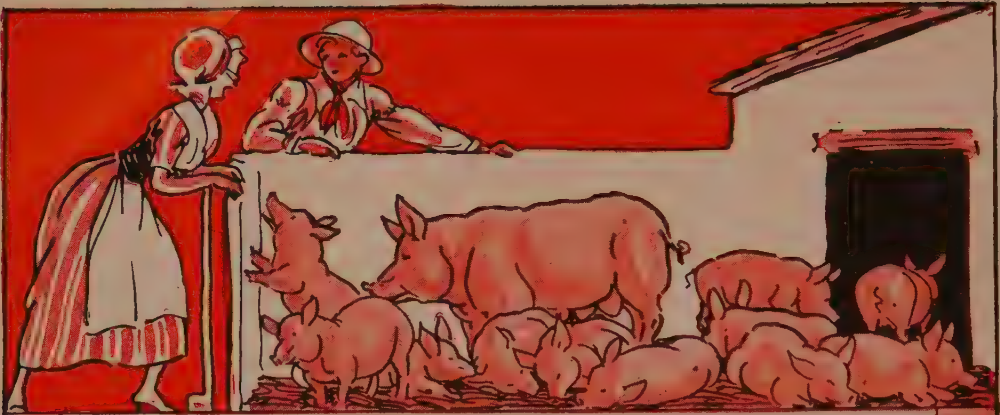


WHEN I was a farmer, a farmer's boy,
I used to keep my master's hens:
With a cluck-cluck here, and a cluck-cluck there,
Here a cluck, and there a cluck, and everywhere a cluck;
My pretty lass, will you come to the banks of the Aire-o?

When I was a farmer, a farmer's boy,
I used to keep my master's ducks:
With a quack-quack here, and a quack-quack there,
Here a quack, and there a quack, and everywhere a quack;
With a cluck-cluck here, and a cluck-cluck there,
Here a cluck, and there a cluck, and everywhere a cluck;
My pretty lass, will you come to the banks of the Aire-o?

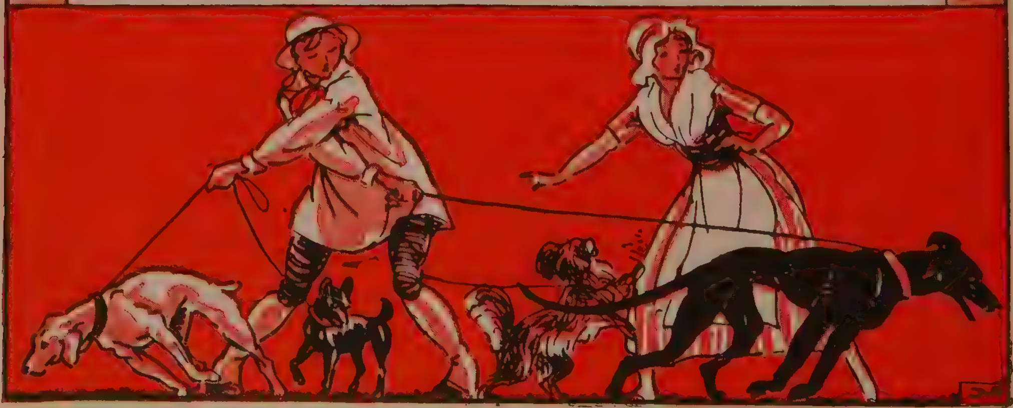
When I was a farmer, a farmer's boy,
I used to keep my master's lambs:
With a baa-baa here, and a baa-baa there,
Here a baa, and there a baa, and everywhere a baa;
With a quack-quack here, and a quack-quack there,
Here a quack, and there a quack, and everywhere a quack;
With a cluck-cluck here, and a cluck-cluck there,
Here a cluck, and there a cluck, and everywhere a cluck;
My pretty lass, will you come to the banks of the Aire-o?





When I was a farmer, a farmer's boy,
I used to keep my master's pigs:
With a grunt-grunt here, and a grunt-grunt there,
Here a grunt, and there a grunt, and everywhere a grunt;
With a baa-baa here, and a baa-baa there,
Here a baa, and there a baa, and everywhere a baa;
With a quack-quack here, and a quack-quack there,
Here a quack, and there a quack, and everywhere a quack;
With a cluck-cluck here, and a cluck-cluck there,
Here a cluck, and there a cluck, and everywhere a cluck;
My pretty lass, will you come to the banks of the Aire-o?

When I was a farmer, a farmer's boy,
I used to keep my master's dogs:
With a bow-wow here, and a bow-wow there,
Here a bow, and there a bow, and everywhere a bow;
With a grunt-grunt here, and a grunt-grunt there,
Here a grunt, and there a grunt, and everywhere a grunt;
With a baa-baa here, and a baa-baa there,
Here a baa, and there a baa, and everywhere a baa;
With a quack-quack here, and a quack-quack there,
Here a quack, and there a quack, and everywhere a quack;
With a cluck-cluck here, and a cluck-cluck there,
Here a cluck, and there a cluck, and everywhere a cluck;
My pretty lass, will you come to the banks of the Aire-o?



When I was a farmer, a farmer's boy,
I used to keep my master's turkeys:
With a gobble-gobble here, and a gobble-gobble there,
Here a gobble, and there a gobble, and everywhere a gobble;
With a bow-wow here, and a bow-wow there,
Here a bow, and there a bow, and everywhere a bow;
With a grunt-grunt here, and a grunt-grunt there,
Here a grunt, and there a grunt, and everywhere a grunt;
With a baa-baa here, and a baa-baa there,
Here a baa, and there a baa, and everywhere a baa;
With a quack-quack here, and a quack-quack there,
Here a quack, and there a quack, and everywhere a quack;
With a cluck-cluck here, and a cluck-cluck there,
Here a cluck, and there a cluck, and everywhere a cluck;
My pretty lass, will you come to the banks of the Aire-o?

When I was a farmer, a farmer's boy,
I used to keep my master's horses:
With a gee-wo here, and a gee-wo there,
Here a gee, and there a gee, and everywhere a gee;
With a gobble-gobble here, and a gobble-gobble there,
Here a gobble, and there a gobble, and everywhere a gobble;
With a bow-wow here, and a bow-wow there,
Here a bow, and there a bow, and everywhere a bow;
With a grunt-grunt here, and a grunt-grunt there,
Here a grunt, and there a grunt, and everywhere a grunt;
With a baa-baa here, and a baa-baa there,
Here a baa, and there a baa, and everywhere a baa;
With a quack-quack here, and a quack-quack there,
Here a quack, and there a quack, and everywhere a quack;
With a cluck-cluck here, and a cluck-cluck there,
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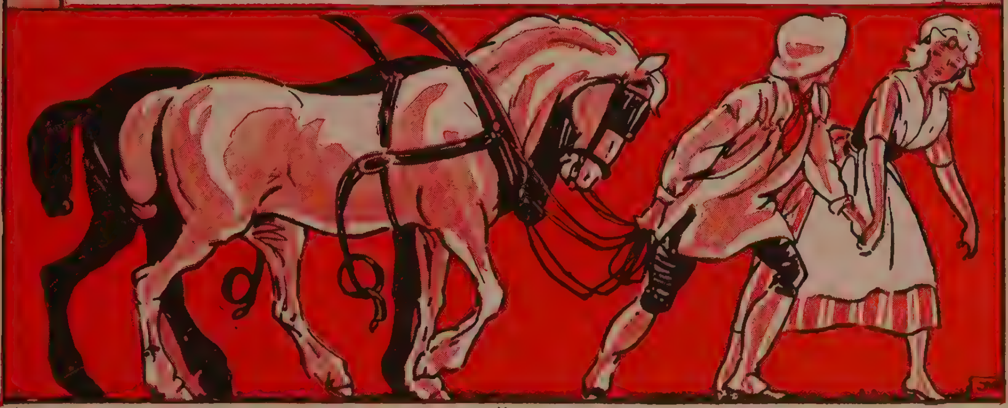
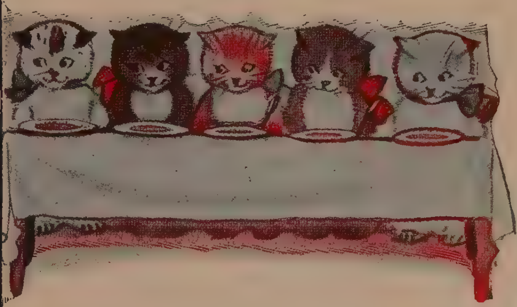
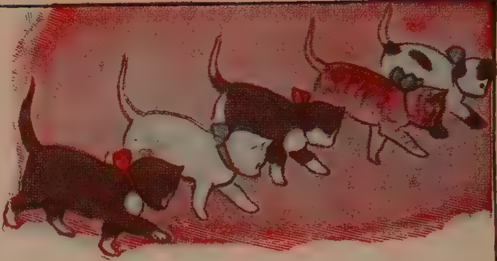
My pretty lass, will you come to the banks of the Aire-o?



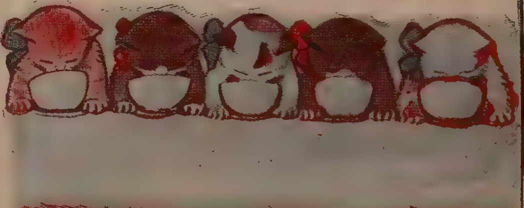
FIVE little pussy-cats, invited out to tea,
Cried: "Mother, let us go. Oh, do! for good we'll surely be!
We'll wear our bibs and hold our things as you have shown us how—
Spoons in right paws, cups in left—and make a pretty bow;
We'll always say, Yes, if you please, and 'Only half of that!'"

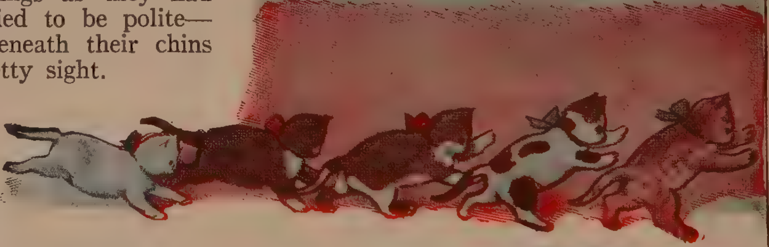


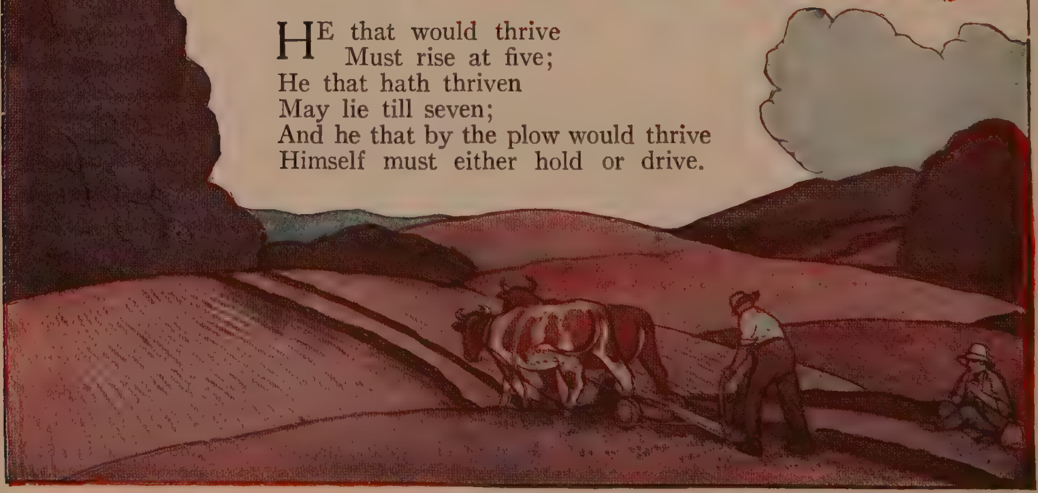
"Then go, my darling children," said the happy mother cat.
The five little pussy-cats went out that night to tea,
Their heads were smooth and glossy, their tails were swinging free;
They held their things as they had learned, and tried to be polite—
With snowy bibs beneath their chins they were a pretty sight.



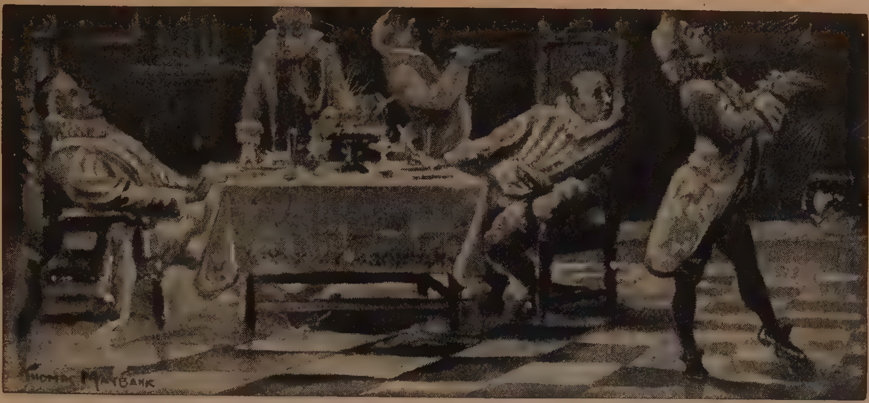
But, alas for manners beautiful and coats as soft as silk,
The moment that the little kits were asked to take some milk
They dropped their spoons, forgot to bow, and—oh, what do you think?
They put their noses in their cups, and all began to drink!
Yes, every naughty little kit set up a meow for more,
They knocked the teacups over, and scampered for the door!







HE that would thrive
Must rise at five;
He that hath thriven
May lie till seven;
And he that by the plow would thrive
Himself must either hold or drive.



THE KING'S GUEST

ONCE upon a time there was a rich man who was very cruel to the poor people living on his estates. They were very poor people indeed, and the rich man, who owned all the land and employed all the people, paid them very low wages, and oppressed them in every way. There came a famine in the land, and the poor people went to the rich man's castle and begged for bread, but the rich man refused them even a crust.

The king of the country heard all this and he sent for the rich man to come and dine with him. You may imagine how proud the rich man was when the king's invitation came. He got out his best horses and his best carriage, and dressed up his servants in splendid livery, and drove to the king's palace.

The king led him into the dining-room, where the table was laid for two. It was laden with choice flowers and fruits and with foods of every kind, and there were the king's servants to wait upon him and his guest.

They brought the soup to the king, and he drank it, and when he had nearly finished it they brought the rich man some soup. But just as he was about to taste it the king finished his soup, and the attendants took the plates away, so that the rich man had not even a spoonful. Then they brought the king another dish, which he enjoyed, and just as he was finishing it they brought the rich man's dish. But before he could touch his knife and fork, the king finished, and both plates were taken away.

And so they brought the king dish after dish, and the king said continually to his guest how good these things were and he hoped the rich man was enjoying them. Yet every time the rich man tried to taste his food his plate was taken away. At last the dinner ended, and the rich man had not had a single bite of food. Not even a crust of bread could he get, for the servants forgot to bring him any; and when you are dining with a king you must not ask for anything. And, of course, the rich man was very hungry, for he had been so busy getting ready for this dinner with the king that he had had nothing to eat all day.

When the meal ended, the king led the rich man into the hall, and bade him good night, and set him out on the long road to his castle. Not a word did he say about the strange dinner at which his guest had eaten nothing, but the rich man went home almost famished with hunger, and he never forgot the lesson which the king had silently taught him. He was very good to the poor after that, and became their true friend.

THE STORY OF MIDAS

THE KING WHO HAD THE GOLDEN TOUCH

ONCE there was a king in Thrace named Midas, the same Midas of whom it was said that he had the ears of an ass. Now, Midas loved gold, not because of what it would buy, or the good he could do if he had it, but because he was a miser. Even when he walked among the rose trees in his beautiful garden he wished that he could turn all the roses into gold. There was just one thing in the world that he loved more than gold, and that was his only child, his little blue-eyed, golden-haired daughter.

There was in that country a powerful youth named Dionysius, whom some call Bacchus. He was the spirit of the springtime, and of all youth and gladness. Now, Dionysius had an old companion named Silenus, who had brought him up. And one day Silenus strayed into Midas' rose-garden, and as he slept in the shade of a rosebush, the gardeners found him and brought him to Midas to be punished as a trespasser. But Midas was pleased with him, and instead of punishing him made a great feast for him and sent him home.

Then Dionysius, who dearly loved Silenus, went to Midas, and said: "Ask me what you will, and if it lies within my power, I will give it to you."

And Midas said with eagerness: "Let me have the golden touch."

Dionysius, who had thought that Midas, as a good king ought, would have asked for some gift which would have made his people happy, looked at him with sadness, and slowly said: "The gift is yours"; and then he went away.

When the god was gone, Midas sank into his chair, and as he touched the seat it turned to gleaming gold.

He looked at it enraptured. He touched it. He rubbed it with the sleeve of his mantle to make it shine more brightly. There was no doubt about it. It was gold, pure gold, and with growing excitement he walked about the hall, touching things here and there as he went, until the great room flashed as the morning sun shone in upon it through the open doors and windows.

When the hall was finished to his liking, he went out, and stepped down into his garden of roses, leaving golden footprints as he went. The garden was a lovely spot. There were roses on every side, from the blooms of snowy whiteness that his little daughter loved, and flowers of palest pink, to great crimson beauties with golden hearts. Their refreshing fragrance spread around and rose upward to the blue sky above them. It was still early in the day, and the air was full of the song of birds and the busy hum of bees. But Midas cared for none of these things. He was still hungry for gold, and he quickly went from bush to bush, touching each one as he went. At last his work was done, and as he turned away, the golden tinkle of the leaves and flowers, as they waved stiffly in the breeze, seemed to him the sweetest music he had ever heard.

In his excitement over the promise of the god, he had forgotten to eat breakfast. Now it was past noon, and as he felt both hungry and thirsty, he hastened back to his golden hall and called to his slaves to bring him food. They did so, and he sat down with eager appetite to eat it. But as the morsels touched his lips the food turned to gold, and the wine and water flowed tinkling back into the cups to settle in a solid mass of gold. He sat and looked aghast at his golden treasure, for of what use were golden cups and platters if he must die of hunger? His gloomy thoughts were broken by the sound of bitter childish weeping, and as he raised his eyes, his little daughter came running into the hall, a spray of golden roses in her hand.

"Father, dear father," she cried, "someone has killed all our beautiful roses!"

"I turned them into gold, my child," said Midas gently; "they are far more beautiful so."

"Ah, no," said the little one; "put them back, father, put them back!" and as she sobbed out the words she flung herself into his arms. Lovingly he put his hand on her head, and began: "My little daughter," when he felt her stiffen in his arms, and in a moment he held only a golden statue.

Horrified, he laid her down on a couch near by and cried aloud for help, but all his servants had fled in terror of their lives, and he was left alone.

All day the mourning father sat in the silent house beside the statue that had been his child, hoping only that death would come soon and take him too. But as the sun set Dionysius once more appeared, seeming to bring renewed life and joy into the lonely dwelling. Still, his face was stern as he said to Midas: "Are you yet satisfied?"

And Midas answered humbly: "I was wrong. There are many gifts that are better far than gold. I had them, and I did not know it. Is it too late? Will you take back the fatal gift? For myself I ask nothing, but bring my little child to life, and let me see her skip about once more before I die."

Then Dionysius bade him go to the river flowing by his garden and bathe there if he would lose his hateful power. With a grateful smile the king turned to thank the god, but Dionysius was no longer beside him.

So Midas hastened to the river and let the waters close round him; and as he stepped out upon the bank he left the bed of the stream all bright with sands of gold. Refreshed and light of heart, he carried water from the river to sprinkle upon the roses as he passed between them. Then, returning to the lovely golden form that was his daughter, he poured restoring drops upon her head.

With a little gasp she looked up at him, then down at the spray of roses in her hand. "Father," she said, "I had a horrid dream. I thought that someone had turned our lovely roses into hateful, ugly things of gold."

"Shall we go," said Midas, "and make sure that it is not true?"

Hand in hand Midas and his little daughter went out into the garden where the roses bloomed.

"It was only an ugly dream," the little girl said merrily. And her father answered: "Yes, my daughter; it was all a hateful dream."

THE LONELY SHEPHERD BOY

SOME years ago a little French boy was following his flock over the pasture lands of Gascony. It was a lonely life, for he was out all day and sometimes half the night, and seldom met anyone. Nor did little Denys Puech like being a shepherd. His heart was not in his work, and to be a farmer when he grew up was not at all what he wished.

Even as a little child Denys had wanted to draw and carve everything he saw; and now, while his sheep nibbled the herbage, the boy modeled little statues out of clay and baked them in the sun, or carved figures out of chestnuts or bits of wood. His fingers were always busy. Sometimes, when he could get paper, he would try to write verses.

At home no one wanted to read his poems, no one cared about his figures, and often Denys was restless and unhappy. A year passed, and one day his master told him to take some sheep to the fair at Estaing. Off he set with his charges, and when he came to the town he was filled with pleasure and surprise.

Presently Denys and his flock arrived at the bridge over the river Lot, and there, while the sheep went on, their young guardian stood still. For on the bridge stood a statue of the Bishop of Rodez. It was the first statue the boy had seen, and he stood as if turned to stone himself, gazing up at it with eyes filled with wonder and admiration.

It seemed to the lad as if a beautiful dream, which he had not quite understood, had come to him in the daylight. It had a secret meaning for him.

Then a thought flashed into his mind. Gathering together a little heap of mud from the roadside, he began to make a figure like the bishop. The passers-by looked curiously at him as he worked on, forgetful of his sheep. Patiently he modeled the figure, carefully copying the very lace on the bishop's robes.

The little statue was nearly finished when a heavy hand fell on the boy's shoulder and a harsh voice began to load him with reproaches. It was his master; and one cannot wonder that he was angry, for his sheep were wandering all over the town, while the young shepherd stood there as if he had nothing to do but amuse himself.

"The lad is not fit for a shepherd!" cried his master.

"He will never do for a farmer!" sighed his parents.

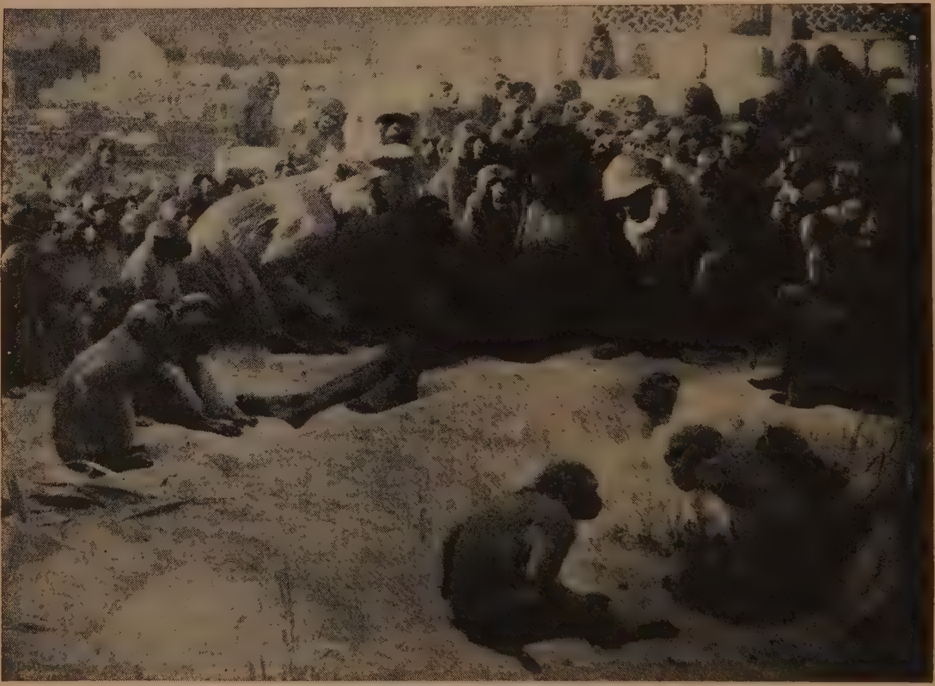
So when Denys was sixteen they gave way, and let him go to a studio and learn to be a sculptor.

The little herd-boy became a famous man, whose beautiful statues are known to the whole of France, and far beyond it.

THE HUNDRED THOUSAND MONKEYS

THIS is a story that begins on the banks of the river Ganges, in India. There are villages on the banks of the Ganges, and in one of them a little boy called Singh lived in a hut with his father and mother. It was his business to make curry for his father and mother while they were busy out of doors.

But one day Singh found it hot and also dull in the hut where he was busy with the curry. The sun was hotter still outside, but when he went to the door and looked out, Singh saw cool shadows under the tree, cooler than the dark of the hut because of the breeze that was lifting the big leaves and letting them flap softly back again. So Singh went and lay in the shadow of the tree.



"AAH!" SAID A HUNDRED THOUSAND SERIOUS-FACED APES

From the painting by J. C. Dollman, A.R.W.S. By permission of Sir Alfred Hickman, Bart.

Presently his father and mother came back hungry for their curry, and when they found that Singh had forgotten all about it, they beat him till he was very sore, and then made curry for themselves.

Singh ran away into the forest.

There were parrots in the forest, green and red and yellow, and they shrieked loudly as they flew from the palm to the banyan tree, and from the acacia to the feathery bamboo. There were snakes, spotted and shiny ones, brown and yellow ones, and black ones, and pale bright green ones, and they hissed and slid away into the long grass. There were bigger things, too.

Singh heard the bamboos crack and the branches break, and saw the long grass wave where the big beasts were stepping. He also heard them roar. He thought they would probably eat him; but he did not mind, because his body was sore. And then a monkey dropped to the ground in front of him. The monkey had been hanging by one hand from the bough of a tree watching Singh for some time.

"What is the matter with you?" asked the monkey.

"I have been beaten," said Singh.

"No, no, that is not what is the matter with you," said the monkey.

"What is it, then?" said Singh.

"Why, yes. Your beating is over, and your skin is already not so sore as it was. The matter with you is that you want to tell a hundred thousand people about it, and there's no one to listen to you."

"Yes," sobbed Singh, "that is quite

true. They are eating curry in the village, and if I try to tell them about it they will only beat me again and make me more sore."

"Come with me," said the monkey, "and you shall tell a hundred thousand people, and they shall weep for your sore body, and you will feel better."

He caught Singh with his skinny hand, and ran through the undergrowth of the forest. Singh ran with him for a long time. He was too busy dodging branches, and jumping over fallen logs or puddles of mud, to notice how they went; so that he was not very much surprised when the trees came to an end and the forest opened into a white old city lying in marble ruins. There were fallen temples and wonderful broken pavements, and everything shone dead white in the hot, glaring Indian sunshine.

There were no people in the city, but as for monkeys—there seemed to be more than Singh believed there were in all the forests of the world.

"Tell these people," said the monkey who had brought him. And when the other monkeys crowded up, this monkey looked laughingly at Singh, and went away, and sat alone on the marble steps of what had long ago been a temple.

"I have been beaten and my back is sore—" began Singh.

"Aah!" said a hundred thousand serious-faced apes, their eyes fixed steadily on his face.

"Because I lay in the sun and neglected the curry while they were working."

"Aah!" said the hundred thousand apes, all looking very much interested.

"My name is Singh, and I am very miserable."

"Aah!" said the apes.

"The people of the village have cast me out with a sore skin and no curry."

"Aah!" said the apes.

"A sore skin and no curry," said Singh again, for he could not think of anything else to say.

"Aah!" said the apes, as if these were only the beginnings of his troubles.

Singh could not think of anything else, and he was very unhappy, because he wanted to complain.

"Aah!" said the apes.

"A sore skin," said Singh miserably.

"Aah!" answered the apes impatiently. He heard some of them say, "Is that all?"

"No curry," he said once more; and then getting up quickly, he looked for the monkey who had brought him.

"Please take me back," he said. "I am not miserable enough for these people."

And the monkey said, "I thought so," and laughed, and took him back. But he was not beaten again. His mother was glad to see him, and gave him hot curry and put him to bed.

Now, that is the best of all ways to be comforted. If ever you feel miserable, go and tell it to a hundred thousand serious-faced monkeys, and you will find that you are not miserable enough.

THE KAFIR AND THE LION

AN old Kafir was trudging slowly back to his master's farm in northern Rhodesia when he heard a sound in the bush that made his blood run cold. A white stranger would not have known what the slight but continual crackling in the brushwood meant, but the native knew and trembled.

A lion was following him and watching him as a cat watches a mouse. But, not being emboldened by hunger, it was waiting till nightfall to make its spring. Unhappily, it was already growing dusk, and the farm was still far off, and the old man had no other weapon than the stick that he was tottering along with.

How could he escape? There was no bush high enough to protect him from the lion. But as he went along the old negro worked out a plan, a simple but very daring plan, which no white man would have thought of.

On coming to a low hill that sloped gently up on one side and then ended in a sudden precipice, the native slowly walked up it, and sat on the edge of the rock. Half turning his head, he saw the lion watching him.

As soon as it grew dark, the old man climbed down to a footing underneath the precipice, and putting his hat and coat on his stick, he lifted it above the rock. In the meantime the lion had been creeping up. When within striking distance, he made a sudden leap at the hat and coat and stick, and over the precipice he went, and landed on the plain with a broken neck. The next morning the wise old Kafir had the pleasure of skinning his dreaded enemy.

THE STORY OF DAY

From a Letter by the Painter Corot

"LOOK you, it is charming, the day of a landscapist. He rises early, at three in the morning, before the sun; he goes and seats himself at the foot of a tree. He watches and waits. There is not much to be seen at first. Nature resembles a whitish canvas upon which the profiles of certain masses are vaguely sketched; all is fragrant, all thrills under the freshening breath of the dawn.

"Bing! the sun is becoming clear—the sun has not yet rent the gauze behind which hide the meadow, the valley, the hills of the horizon—The vapors of night still creep like silvery tufts over the cold, green grass. Bing! Bing! a first ray of the sun! a second ray of the sun! The tiny flowerets seem to awake joyous; each one has its drop of trembling dew; the leaves, sensitive to the cold, move to and fro in the morning air—Under the foliage the birds sing unseen—It seems as if it were the flowers saying their prayers. The loves, on wings of butterflies, descend upon the meadow and make the tall grasses sway to and fro. One sees nothing—everything is there—the landscape is all there behind the transparent gauze of the mist, which rises, rises, rises, inhaled by the sun, and discloses in rising the river scaled with silver, the meadows, the trees, the cottages, the vanishing distance. One distinguishes at last that which one divined at first.

"Bam! the sun has risen. Bam! the peasant passes at the end of the field with his cart drawn by two oxen. Ding! ding! it's the bell of the ram that leads the flock. Bam! bam! all bursts—all glitters—all is in full light, blond and caressing as yet. The distances, simple in contour and harmonious in tone, lose themselves in the infinity of the sky across an air misty and touched with azure. The flowers uplift their heads; the birds flit hither, thither. A countryman, mounted upon a white horse, disappears in the hollow path; the little rounded willows seem to be spreading themselves like peacocks upon the bank of the river. It is adorable, and I paint—and I paint—Oh! the beautiful fawn-colored cow, sunk up to her dewlap in the damp grass; I am going to paint her—*crac!* there she is! Famous, famous! *Dieu,* how well I've hit her off! Let's see what that peasant will say who is watching me paint and does not dare to approach. 'Ho, Simon!' Good; here is Simon approaching and looking. 'Well, Simon, what do you think of that?' 'Oh, well, Monsieur, it's very beautiful, of course (*Oh dom, M'sieu, c'est bien biau, allez!*)' 'And you see well what I meant to paint?' 'Why, of course, I see what it is; it's a large yellow rock you've put there.'

"Boom! boom! noon! the sun aflame burns the earth. Boom! everything grows heavy, everything becomes serious—the flowers hang their heads, the birds are silent, the sounds of the village come to us; they are the heavy laborers, the smith whose hammer resounds upon the anvil. Boom! let us return home—One sees everything; there is nothing there longer. Let us go and breakfast at the farm, a good slice of home-made bread, with butter freshly churned—eggs, cream, ham—Boom! Work, my friends, if you will! I rest, I take my noon nap—and I dream a morning landscape—I dream my picture—by and by I will paint my dream.

"Bam! Bam! The sun sinks towards the horizon—It is time to return to work. Bam! the sun gives a blow of tam-tam. Bam! it sets amidst an explosion of yellow, of orange, of fire red, of cherry, of purple.—Ah, it is pretentious and vulgar; I don't like that—Wait; let's sit down there at the foot of the poplar—close to that pond, as smooth as a mirror.

"Nature has a tired mien—the flowerets seem to revive a little—poor flowerets, they are not like the rest of us men, who find fault with everything. They have the sun on the left—they are patient. 'Good,' they say to themselves, 'presently we'll have it on the right'—They are thirsty—they wait. They know that the sylphs of the evening are going to sprinkle them with vapor from their invisible watering pots; they wait in patience, giving thanks to God.

"But the sun sinks more and more behind the horizon. Bam! Bam! it casts its last ray, a smoke of gold and purple which fringes the fleeing cloud. Now then see! it has altogether disappeared! Good! Good! the twilight begins.

"*Dieu,* how charming it is! The sun

has disappeared—There remains in the softened sky only a vaporous tint of pale lemon, the last reflection of that charlatan of a sun, which melts into the deep blue of night in passing through the greenish shades of pale turquoise, of a fineness unheard of, a delicacy fluid and intangible. The fields lose their color—the trees only form brown or gray masses—the darkened waters reflect the soft tones of the sky. One begins to see nothing more—one feels that everything is there—All is vague, confused. Nature is falling asleep—yet the fresh air of the evening sighs among the leaves; the birds, those voices of the flowers, repeat the evening prayer—The dew strews with pearls the velvet of the lawn—the nymphs flee, hide themselves—and desire to be seen.

"Bing! a star of heaven plunges head foremost into the pond. Charming star, whose scintillation the trembling of the water increases; you are looking at me—you are smiling at me and winking too—Bing! a second star appears in the water, a second eye opens. Welcome, fresh and smiling stars. Bing! bing! bing! three, six, twenty stars, all the stars of heaven have given each other a tryst in that blessed pond. All grows still darker—Only the pond scintillates—It is a swarming of stars. The illusion is produced—The sun having hidden itself, the inner sun of the soul, the sun of art rises—*Bon! Voilá mon tableau fait!*" And afterward—

"After my excursions I invite Nature to come and pass several days with me. Brush in hand, I hunt for nuts in the forest of my *atelier*. I hear there the birds singing, the trees trembling under the wind. I see there the brooks flowing, and the river charged with a thousand reflections of the sky and of all that lives upon the banks—the sun rises and sets *chez moi*."

A LITTLE LETTER

THE following whimsical letter is written to Miss Gertrude Chataway, a little girl who met Lewis Carroll at the quiet seaside resort of Sandown, in the Isle of Wight.

Christ Church, Oxford,
Dec. 9, 1875.

My dear Gertrude:

This really will *not* do, you know, sending one more kiss every time by post; the parcel gets so heavy it is quite expensive. When the postman brought in the last letter, he looked quite grave.

"Two pounds to pay, sir!" he said. "*Extra weight*, sir!" (I think he cheats a little, by the way. He often makes me pay *pounds*, when I think it should be *pence*.)

"Oh, if you please, Mr. Postman!" I said going down gracefully on one knee (I wish you could see me go down on one knee to a postman—it's a very pretty sight), "Do excuse me just this once! It's only from a little girl!"

"Only from a little girl!" he growled. "What are little girls made of?"

"Sugar and spice," I began to say, "and all that's ni—" but he interrupted me. "No! I don't mean *that*. I mean what's the good of little girls when they send such heavy letters?"

"Well, they're not *much* good, certainly," I said rather sadly.

"Mind you don't get any more such letters," he said, "at least, not from that particular little girl." . . .

I promised him we would send each other *very* few more letters—"only two thousand four hundred and seventy, or so," I said.

"Oh!" he said, "a little number like *that* doesn't signify. What I mean is, you mustn't send *many*."

So you see, we must keep count now, and when we get to two thousand four hundred and seventy, we mustn't write any more, unless the postman gives us leave.

I sometimes wish I were back on the shore at Sandown; don't you?

Your loving friend,
Lewis Carroll.

PROVERB STORIES

Every nation has its proverbs—short, pithy sayings containing much wisdom—yet if you were to examine a collection of the proverbs of different nations you would be surprised to find that many of them would be the same.

THE FARMER AND HIS SACKS

A FARMER was taking his grist to the mill in sacks thrown across the back of his horse. On the way the horse stumbled, and one of the sacks fell to the ground. It was too heavy for him to lift, and he was at a loss to know what to do. As he stood wondering he saw a horseman coming toward him.

When the rider came nearer, the farmer saw that he was none other than the nobleman who lived in the great house at the top of the hill. It was impossible to ask help from one of his rank.

The nobleman, however, was something more than a man with a title—he was a gentleman, and he dismounted.

"I see you have had something of a mishap, friend," he said. "It is fortunate I came along just now, for help is not always handy on these roads."

So saying, he took one end of the sack, the farmer took the other, and the load was once more placed on the horse's back.

"My lord," said the farmer, lifting his cap, "how can I thank you?"

"Easily enough, my good fellow," said the nobleman. "Whenever you see anyone in a difficulty, help him all you can, and that will be thanking me."

Repay kindness with kindness.

THE BAG OF PEAS

"DO you believe in luck?" said a king to one of his officers.

"Yes," answered the officer, "I do."

"Ah!" laughed the king. "I am afraid you could not prove to me that there is any such thing in the world."

"That may be, your Majesty," answered the officer; "but if it please you, we might try to find out. I have thought even now of a plan."

He whispered in the king's ear, and his Majesty replied: "Very good, very good indeed; let us try it without loss of time."

So that night the officer hung a bag from the ceiling of one of the rooms in the palace. What it contained none but the king and the officer knew. Then two men were put into the room. When the door was shut, one of the men, who believed in luck, laid himself in a corner and prepared for sleep; the other looked about him, and at once saw the bag hanging from the ceiling.

He reached up and put in his hand, and found some peas. "One might have a worse supper," he thought, as he took out a handful and ate them.

Presently he came on some diamonds, but, in the dark, he thought they were mere stones and of no value. So he threw them toward his companion, saying: "Take the stones for your idleness."

In the morning the king and his officer came to the room and told each man he might keep what he had found. The one man got the peas which he had eaten; the other got the diamonds.

"Now, your Majesty," said the officer, "what do you say?"

"Truly," answered the king, "you seem to have the best of the argument. There may be such a thing as luck; but it is as rare as peas mixed with diamonds."

There's no luck in laziness.

THE TWO KINGS

THERE was once a king who sent a message to the king of a neighboring country, saying: "Send me a blue pig with a black tail, or else—"

To this the other king replied: "I have not got one; and if I had—"

When the first king received this answer he flew into a great rage and declared war against the other. For many weary months fighting went on, but at last the two kings arranged a meeting.

"What did you mean," said the first, "by saying, 'Send me a blue pig with a black tail, or else—'?"

"Why," he answered, "I meant a blue pig with a black tail, or else some other color. And now let me ask you what you meant by your message, 'I have not got one, and if I had'?"

"My meaning was simple enough: if I had had such a pig I should have sent it."

"Dear me, how foolish we have been! Let us make peace and be friends."

So peace was made, and the story was written in the annals of both countries to serve as a warning to those that should come after to be slow to take offense.

The second word makes the quarrel.

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